THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LXII.—No. 16. Whole No. 1,637. | NEW YORK, MONDAY, APRIL 22, 1895. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. H. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE —
Eighteenth Annual Meeting, Western Gas Association..... 561
EDITORIALS —
Briefly Told 562
The Advance in the Price of Oil—The Annual U.G.I. Association Meeting.
A Service and Main Record for Gas Companies, by Mr. H. L. Rice 562
*The Cause of Luminosity in the Flames of Hydrocarbon Gases, by Prof. Vivian B. Lewes..... 563
Municipal Ownership of Public Corporations, by Mr. M. J. Francisco..... 568
Economical Lighting of Public and Private Buildings, Workshops, etc., by Mr. John West..... 569
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 571
Sale of the Lincoln (Ills.) Plant—Annual Meeting, Ann Arbor, Mich.—Death of Mr. Jno. Nix—Annual Meeting, East Albany, N. Y.—The Mayor of Philadelpgia on the Ownership of the Local Gas Works—Gas Cooking Demonstration, Chattanooga, Tenn.—Annual Meeting, Kenton, O.—Annual Meeting, Decatur, Ills.—The Proposed Gas Works for Tampa, Fla.—Combining at Seattle, Wash.—Death of Mr. William F. Spotswood—Lectures on Cooking by Gas, New York City—Mr. Stout Open for a Position—Louisville Does Not Want to Pay Interest—And Other Items.
Thawing Frozen Pipes with Electricity..... 573
Cast Iron Girders 573
CORRESPONDENCE —
Superintendent Enright's Views on How to Push the Placing of Gas Stoves..... 574
The Market for Gas Securities..... 574

[OFFICIAL NOTICE.]

Eighteenth Annual Meeting, Western Gas Association.

OFFICE OF WESTERN GAS ASSOCIATION,
NEW ALBANY, IND., April 17, 1895.

To the Members of the Western Gas Association: The 18th Annual Meeting of the Western Gas Association will be held at Pittsburgh, May 15th, 16th and 17th, 1895, and will be called to order by the President, Mr. I. C. Baxter, at 10 A.M., Wednesday, May 15th.

The Monongahela House has been selected as the headquarters for the members, and the meeting of the Association will be held in a suitable room contained therein. A rate of $3 per day has been obtained for those attending the meeting.

The Executive Committee met at Pittsburgh, last February, and selected the following papers to be presented to the Association:

"Metal Tanks for Gasholders," by Mr. Alten S. Miller, Long Island City, N. Y.

"The Advantage of the Metric System for All Calculations," by Mr. Geo. H. Harper, Altoona, Pa.

"Acetylene," by Mr. F. L. Slocum, Pittsburgh, Pa.

"Recuperative Furnaces, as Applied to Bench Firing: Their Operation and Results," by Mr. J. A. Faux, Pittsburgh, Pa.

"Some Experience with Foul Gas in Holder," by Mr. Jas. T. Lynn, Detroit, Mich.

"Ammoniacal Liquor, with Special Reference to the Universal Saving of Same," by Gas Companies," by Mr. Geo. Osius, Detroit, Mich.

"Natural Gas as the Pioneer for Artificial Fuel Gas," by Mr. Donald McDonald, Louisville, Ky.

"Handling and Storage of Oil by Gas Companies," by Mr. D. J. Collins, Chicago, Ills.

"Best Method of Introducing Gas Engines," by Mr. C. B. Case, Milwaukee, Mich.

"Incandescent Gas Lighting," by Mr. S. M. Highlands, Clinton, Ia.

"Wrinkle Department," edited by Mr. Geo. T. Thompson, St. Louis, Mo.

The Central Traffic Association, Trunk Line, Boston Passenger Committee and Southern Passenger Association have granted rates of 1¼ fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory of the Central Traffic Association is bounded on the east by Pittsburgh, Salamanca, Buffalo and Toronto; on the north by the line of, and including points on the Grand Trunk Railway from, Toronto to Port Huron; thence via Lakes Huron and Michigan, to the north line of Cook county, Ills.; on the west by the west line of Cook county and the Illinois and Mississippi rivers to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, but including points on either side of that river.

The Trunk Line territory is as follows: From Niagara Falls, Buffalo and Salamanca, N. Y., Pittsburgh, Pa., Bellaire, O., Wheeling, Parkersburg and Charleston, W. Va., and points east thereof, except in New England. The names of the roads making the reduction are as follows: Addison & Pennsylvania; Allegheny Valley; Baltimore & Ohio; Baltimore & Potomac; Buffalo, Rochester & Pittsburgh; Camden & Atlantic; Central, of New Jersey; Chesapeake & Ohio; Cumberland Valley; Delaware & Hudson Canal Co.; Delaware, Lackawanna & Western; Elmira, Cortland & Northern; Fall Brook Coal Co.; Fonda, Johnstown & Gloversville; Lehigh Valley; New York Central & Hudson River—Harlem division excepted; New York, Lake Erie & Western; New York, Ontario & Western; New York, Philadelphia & Norfolk; New York, Susquehanna & Western; Northern Central; Pennsylvania; Philadelphia & Erie; Philadelphia & Reading; Philadelphia, Wilmington & Baltimore; Rome, Watertown & Ogdensburg; Western New York & Pennsylvania; West Jersey; West Shore; Wilmington & Northern.

The Boston Passenger Committee territory is from points on the following roads: Boston & Albany; Boston & Maine; Central Vermont; Concord & Montreal; Fitchburg; Maine Central; New York & New England; New York, New Haven & Hartford; Portland & Rochester.

The Southern Passenger Association is composed of the following Companies: Alabama Great Southern; Alabama Midland; Atlantic Coast Line; Atlantic & Florida; Atlantic & West Point; Charleston & Savannah; Central Railroad, of Georgia; Cincinnati, New Orleans & Texas Pacific; East Tennessee, Virginia & Georgia; Georgia Railroad; Georgia Pacific; Georgia Southern & Florida; Jacksonville, St. Augustine & Indian River; Knoxville, Cumberland Gap & Louisville; Louisville & Nashville; Marietta & North Georgia; Memphis & Charleston; Morristown & Cumberland Gap; Nashville, Chattanooga & St. Louis; Pennsylvania; Port Royal & Augusta; Richmond, Fredericksburg & Potomac; Savannah, Florida & Western; South Carolina; Southern Railway Company; Western & Atlantic.

All persons attending the meeting will purchase a first class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased at full tariff fare one first-class ticket to Pittsburgh, which certificate, after it has been signed by the Secretary of the Western Gas Association, and a representative of the above Passenger Associations, who will be in attendance at our meeting, will entitle the holder thereof to one-third fare returning home.

All persons availing themselves of the reduced rates will apply to agent 30 minutes before the departure of train. Tickets in accordance with above arrangement can be purchased on and after Saturday, May 11th, and are good, for return trip, on or before Tuesday, May 21st. All

agents do not have a supply of certificates, but they may be obtained by request, if notification is made in time. Those parties outside the territory embraced by above four Passenger Associations can obtain reduced rates of 1½ fare for the round trip by purchasing tickets to nearest point within above territory, and from there purchasing a ticket to Pittsburgh No refund of fare can be expected because of failure of the parties to obtain certificates.

There will be an exhibit of gas appliances, to which all manufacturers are invited to contribute. Any information, as to space and place of exhibit, can be obtained from Mr. F. L. Slocum, President of the Gas Engineering Company, of Pittsburgh. It is important that exhibitors apply for space at once and complete their arrangements.

This year we meet in new territory, adjacent to which are many Companies whose officials are not members of the Western Gas Association. We hope that many will embrace this opportunity to become members. The Secretary will be pleased to give those desiring to become members any information wanted, and to mail them copies of the Constitution and By-laws.

The Question Box is now ready to receive inquiries, and those obtained before the meeting will be published, so that all may come prepared to answer them. The Secretary will be pleased to have a number of questions sent him. A cordial invitation is extended to members of other Associations to attend our meeting, and it is hoped that many will avail themselves of the opportunity to be present.

JAS. W. DUNBAR, Secretary.

BRIEFLY TOLD.

THE ADVANCE IN THE PRICE OF OIL.—The topic at present uppermost in the minds of "purchasing agents" of gas companies is the market price of crude oil, the quotations for which have been marked up with wonderful rapidity in the last 30 days. The highest rate recorded for the year was that reported yesterday (Wednesday, April 17), when the maximum showed $2.70 per bbl. on the Oil City Exchange, and the daily newspapers report that the Standard Oil Company on the same date put the price for crude oil in the Pennsylvania producing fields at $2.50 per bbl. This is the highest price recorded for crude since 1877. In January of that year the maximum price for that twelvemonth was recorded at $3.70. The lowest price for 1877 was made in June—$1.53¾ ber bbl.; and the average price for that year was $2.37. The hardening tendency in crude was first notably manifested towards the close of 1894, when the price per bbl. touched 95¼ cents, against the minimum price of 79 cents in January, the average price for the year being 83.6 cents. It is notable, too, that this average price was higher than the averages for '93, '92 and '91, which were, respectively, in cents, 64.04, 55.60—the lowest average since 1861, which was 42 cents—and 67. It is, of course, the gas oils of all grades in which gas makers are most interested, but as in this case the hair goes with the hide, the rate for crude is that which will eventually determine the price of gas oils. Naphthas of the grades ordinarily used for enriching water gas have been advanced to 6 cents and over per gallon, and at such figures gas consumers will of necessity be called upon soon to "educate" themselves to the point of knowing that 25-candle gas, at $1 per 1,000 cubic feet, or even at a higher figure, is no longer to be their portion. It would be quite useless at this time to speculate on the real causes that underlie the flighty condition of the oil market, and while no doubt decreased production is largely responsible for it, we imagine that the politics of the party which hugely predominates the producing fields may be fairly charged with as much of the increase as is put to the account of shrinkage in the pipe line runs. We do not think it likely that the maximum advance will be long maintained. Should the reverse be the case, it needs no prophet to figure what the ultimate result in the gas industry will be—to put it concisely, enriching oil at 7 cents per gallon means a hurried return to the manufacture of coal gas. The following table of crude oil prices for the past 36 years, which was printed in the *Sun* of April 17th, will no doubt be interesting:

	Highest.	Lowest.	Average.		Highest.	Lowest.	Average.
1859..Sept..	$30.00	Sept..	$19.50	$19.77	1877 Jan...	$3.70	June..	$1.53¾	$2.37
1860...Jan...	20.00	Dec....	2.00	9.77	1878..Feb...	1.86¾	Sept ..	.78¼	1.17
1861...Jan...	1.75	Nov...	.08	.42	1879 Dec...	1.28¼	June..	.63¼	.86
1862..Oct. ..	2.00	Jan....	.10	1.00	1880..June..	1.24¾	April..	.70¾	.95
1863..Dec...	4.00	Jan....	2.00	3.11	1881..Sept..	1.01¼	July ..	.73¼	.85
1864...July ..	14.00	Feb...	3.75	5.85	1882..Nov...	1.36	July ..	.49¼	.79
1865...Jan...	10.00	Aug ..	4.00	6.65	1883..June..	1.24	Jan....	.83¾	1.06
1866..Jan...	5.00	Dec....	1.65	3.76	1884..Jan. .	1.15	June..	.51¾	.84
1867..Sept. .	4.00	June..	1.50	2.40	1885. Oct...	1.13¾	Jan....	.68	.88¼
1868...July ..	5.50	Jan....	1.80	3.75	1886. Jan...	.92¼	Aug ..	.50¾	.71¾
1869...Jan...	7.00	Dec....	4.25	5.64	1887. Dec...	.90¾	July ..	.54	.69⅞
1870...Jan...	4.90	Aug ..	2.75	3.86	1888..March .	1.00	June..	.71¾	.87¼
1871..June..	5.15	Jan....	3.40	4.42	1889..Nov...	1.12½	April..	.80	.94½
1872..June..	4.10	Sept ..	3.00	3.68	1890..Feb...	1.08	Dec...	.60¼	.86 7-10
1873...Jan...	3.05	Dec....	1.00	1.84	1891..Feb...	.81	Aug ...	.51¼	.67
1874..April .	1.90	Dec....	.45	1.17	1892..Jan .	.64½	Oct ...	.50	.55 3-5
1875..April .	1.65	Jan....	.90	1.33	1893..Dec. .	.79½	Jan....	.53	.64 2 25
1876..Dec...	4.23¾	Jan....	1.48¾	2.61	1894..Dec...	.95¾	Jan....	.79	.83 6-10

THE ANNUAL U. G. I. ASSOCIATION MEETING.—The annual meeting of the Superintendents of the different Companies controlled by the United Gas Improvement Company was held in Philadelphia last week. The attendance was excellent, and many topics of interest (including the state of the oil market) were intelligently discussed. A feature of the meeting was the visit to the Welsbach Company's plant at Gloucester, N. J., the inspection of the shops being followed by the demolition of a shad dinner. The finny beauties were served "planked," *a la* Delaware.

[Prepared for the JOURNAL by Mr. H. L. Rice, Supt. of Distribution, Milwaukee (Wis.) Gas Light Company.]

A Service and Main Record for Gas Companies.

In the triumvirate of the gas industry little "Distribution" has always played the minor roles, shy and oft-times well-nigh forsaken, completely overshadowed by her big brothers "Management" and "Manufacture." Verbal orders to prodigiously long memoried foremen, records of mains and services, only conspicuous by their total absence, memoranda on loose slips of paper, have often, it would seem, been the rule in many companies where the costs per thousand of manufacture were most religiously analyzed. But the awakening which has come, while it has been slow, has been no less sure, and the company which to-day cannot claim some more or less extensive knowledge of its mains, services, meters and repairs, and some iteming of the costs of these various departments, is far behind the times.

It is not the writer's intention to claim any pre-eminence whatever for the system of record keeping, the growth and workings of which he is about to describe. He merely desires to add his mite to the scanty literature on the subject, hoping that the example will be contagious, and that so important a matter may at length receive the attention it deserves.

The long-memoried foreman was not lacking in the particular case under consideration. It seems almost an insult to such an intelligence to transfer its subtleties to unappreciative paper; yet the thankless task was undertaken. The regular insurance maps of latest date (happily, 1894) were secured, and all the mains of more recent and more careful record were drawn in in proper position by single lines. The ordinary main map, together with the brain aforementioned, furnished the rest, and the whole system was soon transferred to the large scale atlas. Only one color was used, a constant position within the street lines was assumed, and the distance from the curb line, together with the main sizes, lettered in each block and on each crossing. The work as completed could only be assumed to be approximately correct, but it was a beginning—a card catalogue of services had been started somewhat earlier.

This manner of taking care of services, while not new in idea, has not perhaps been undertaken by many companies, and a description may be of interest. The card used is as follows:

.....*Street.* *No.*.....

Application made by ..... Lessee / Owner

do *No.*.....*Dated*.....*Deposit*, $.....

Service Order No......*Dated*.....*Put in*.....

Extension No.....*Dated* .....*Put in*.....

.....

Total cost, $.....*Am't charged consumer*, $.....*Net cost*, $.....

Date charges paid .....*C. B. Folio*.....

Remarks.....

Location and Description.

Stop Box.....*ft. from* Lot / Curb *Line, and*.....*ft. from*.....*Line of*

....*and*.....*ft. from*.....

.....

Size of Service to Curb.....*inch.* *Renewed*.... ....*inch*.....

Size of Extension .....*inch.* *do* .....*inch*.....

Size of Stop Box.....*inch.* *Size Stopcock or Valve*....*inch*

Date Service covered..... *Date cut off*.....

Where cut off.....

No. Meters Supplied.....*No. Lights supplied*.....

Class of Building.....

.....

The reverse side is ruled for remarks and miscellaneous data. As will be seen, some of this information is superfluous, and in fact not all of the items have been filled out in practice. The main features are, of course, the order number for back reference, and the description, date, size and location of the stop box and service. The cards were made up from the records as far as they went, and then the ledgers were resorted to. The list of past and present gas consumers having been secured, as nearly complete as possible, the cards were filled out in blank with the house numbers. Men were then sent out on the streets, and each individual service was located and entered on its card, together with all such information as to stop boxes, pipe sizes, etc., as could be picked up in passing. The crude catalogue, arranged by streets and numbers in its nine drawers, thus stood complete in its most important features.

The next step was to enter it upon the atlas as well. As the scale was 50 feet to the inch, and as every house in the city was shown in its correct location, this was a simple matter, each service being shown by a single line drawn from main to building at the proper point. Some few unknown stretches of main pipe came to light in the process, and not a few measurements proved faulty and had to be repeated. This is our record of mains and services as they stand to-day. I have dilated on its production that the difficulties in the way may not be magnified by the uninitiated. Its amplification and approach to absolute correctness are only matters of time. Not a piece of main or service pipe is uncovered nowadays without the information secured going to enlarge and correct or verify the record. Fortunately the cardboard of the atlas will stand lots of scratching. The meter department furnishes a list of services from day to day, with the size of pipe found. Discoveries of unknown services are frequent, and these are followed up and secured. No means of obtaining information is ignored, and the catalogue has thus become the pet of the office. The application of the system is simple. New services are filled out on the cards as the returns come in, and the least peculiarity noted or sketched out on the reversed side. They are then transferred to the atlas, and it may be well to mention here that this latter is kept up to date by its makers, by the addition of neat stickers. New mains are drawn in as fast as laid, with all the larger size crosses and tees carefully noted. Drips could be added, but the small main map has proved sufficient for these so far.

No application for service is passed upon without first referring to the catalogue, and not a few mistakes are thereby remedied; perhaps not a little waste of labor saved. The question of on or off main is no longer guesswork, where parts of blocks have been run, but is reduced to a certainty, and useless orders are thereby at a discount. And one can be assured that not a few puzzling questions but will find in the future in these nine small drawers, or on this atlas, their first light and the first index to their solution.

Need I say a single word to the progressive gas manager as to the advantage of having pictured before him at a glance the whole array of houses in his city and on his lines of mains not using gas? I doubt it; nor need I expatiate on the great convenience of being able in a moment's time to determine the exact run of pipe necessary to include any would-be new consumers or to satisfy any unexpected or aldermanic demand. One curious example of usefulness may be of interest. During a recent conflagration of considerable extent in our city, some five services, all about 3 inches in size, became broken off by the fall of the buildings. Everything was hidden from sight under the *debris*, and the pipes themselves gave no sign of their position, for one of them lying under water was flooding the main, and had already cut off the gas supply of the entire neighborhood. Our forman's memory was a good thing here, but the atlas was far better—a brief study and hasty sketch, a glance at the cards, and the whole thing was in hand, the services easily found, the main pumped out, and the remaining meters, heedless of the family loss up the street, buzzed again as merrily as ever.

The Cause of Luminosity in the Flames of Hydrocarbon Gases.

[Communicated to the Royal Society by PROFESSOR VIVIAN B. LEWES.]

In a paper read before the Chemical Society in 1893 I showed that in the inner non-luminous zone of a flame of ordinary illuminating gas the hydrocarbons originally present in the gas, and consisting of ethylene, butylene, benzene, methane and ethane, became converted, by the baking action of the walls of flame between which they had to pass, into acetylene, and that at the moment when luminosity commenced over 80 per cent. of the total unsaturated hydrocarbons present consisted of this compound.

The presence of acetylene at the point where luminosity commenced naturally suggested that the luminosity was in some way due to actions in which the acetylene played the principal part—either that it split up into carbon and hydrogen under the influence of heat, and so supplied the flame with the solid particles necessary according to Sir Humphry Davy's theory of the cause of luminosity, or else by its polymerisation it formed the dense vapors required by Dr. E. Frankland's more recent hypothesis.

The Solid-particle Theory Upheld.—In order to elucidate this point, I carried out the long series of experiments upon the action of heat upon flowing ethylene and other hydrocarbons which formed the subject of communications to the Royal Society in 1893 and early this year, in which I showed that whilst flowing through a heated area (the temperature of which was between 800° and 1,000° C.), ethylene decomposed according to the equation—

$$3C_2H_4 = 2C_3H_2 + 2CH_4,$$

and that the acetylene then polymerised into a large number of more complex hydrocarbons, amongst which benzene and naphthaline were conspicuous, whilst at temperatures above 1,200° C. no polymerisation took place, but the acetylene formed from the ethylene decomposed at once into carbon and hydrogen, whilst the methane, which up to this temperature had been but little affected, decomposed into—

$$2CH_4 = C_2H_2 + H_2,$$

and this fresh supply of acetylene at once broke up to carbon and hydrogen; so that at temperatures above 1,200° C. the complete action might be looked upon as being—

$$C_2H_4 = C_2 + 2H_2.$$

These results have an important bearing upon the cause of the luminosity in the flame, as it is manifest that if the temperature of the luminous zone is above 1,200° C., the light emitted must be due to incandescent particles of carbon, and not to incandescent hydrocarbon vapors.

On determining the temperature of an ethylene flame, whilst burning from a small fish-tail burner, by means of the Le Chatelier thermo-couple, used in the way described in my paper on the luminosity of coal gas flames (Chem. Soc. Journal, 1893), I found that the temperatures were as follow:

Portion of Flame.	Height above Burner.	Temperature.
Non-luminous zone.....	½ inch.	952° C.
Commencement of luminosity	1¼ "	1,340 "
Top of luminous zone.....	2 "	1,865 "
Sides of luminous zone.....	— "	1,875 "

showing that luminosity commenced at 1,340° C., and continued even at 1,875° C., temperatures at which the incandescent vapor theory becomes untenable.

It might be urged that the heavy hydrocarbons already produced at a lower temperature in the non-luminous zone are not so easily decomposed by heat as acetylene, and that these may be causing the luminosity, even though carbon particles be present from the decomposed acetylene; but this would hardly be possible, as so little besides acetylene is to be found at the top of the non-luminous zone of an ethylene flame, and it can be experimentally shown that even when benzene vapor is formed and is largely diluted it begins to break up and deposit carbon at 1,200° C.

The supporters of the solid-particle theory of luminosity agree in concluding that the liberated carbon, existing, as it does, in a condition of molecular division, is heated to incandescence partly by its own combustion and partly by the combustion of the hydrogen and carbon monoxide going on around the finely divided carbon particles. As has been pointed out by many observers, it is clear that the carbon particles themselves undergo combustion—otherwise they would escape unburned from the flame—whilst it is manifest that the combustion of hydrogen and carbon monoxide, which plays so important a part in the flame, must add its iota to the temperature attained by them.

Both these sources of temperature, however, would be manifest in the flame itself, and with flames of given size burning from the same description of jet we ought to find that their luminosity is governed by—

A. The temperature of the flame.

B. The number of carbon particles in a given area.

Moreover, we should expect that the higher the temperature of the flame the whiter would be the light emitted; so that a comparatively low temperature flame, even when rich in carbon particles, would be yellow and lurid as compared with the flame containing the same or a smaller number of particles, but which had a higher temperature.

Temperatures and Illuminating Values Opposed.—It has been pointed out by Professor A. Smithells that it is erroneous to consider the temperature of a flame as being the temperature recorded by thermometric instruments inserted into the flame, as by such devices you only obtain the mean temperature of a considerable area of the flame uncorrected for loss from conduction. (Phil. Mag., 1894.) It is also perfectly well known that in a flame a thick platinum wire may only be heated to redness, whilst a thin wire may even be fused; and this suggests that flame temperatures taken by the Le Chatelier thermo-couple of platinum and platinum-rhodium wires may be totally incorrect. In using this beautiful and convenient device, I have found that the length of the wires twisted together makes practically no difference in the recorded temperature, and that one twist is as good as six.

In all my flame experiments I have made the twist as short as possible; and by always using wires of the same thickness have obtained results which are, at any rate, comparable, if not correct. In order to find what difference the thickness of the wires would make, I got Messrs. Johnson and Matthey to draw for me wires of 0,018, 0,011 and

0.003 of an inch diameter; and having calibrated the galvanometer scale for temperature with thermo-couples of the same length of twist made from each of them, I obtained the following results with the same portion of a bunsen flame:

Wire Used.	Temperature.
0.018	1,617° C.
0.011	1,728 "
0.003	1,865 "

These results show that the diameter of the wire seriously affects the temperature recorded under these conditions by the thermo-couple, the same degree of heat being recorded by the fine wire as being 248° hotter than is shown by the thickest wire employed. This discrepancy is probably chiefly due to loss by conduction.

In taking the temperature of heated gas flowing through a tube, this source of error is but small, as, some considerable length of wire being heated on each side of the twist, conduction has but little effect on the thermo-couple itself; but in determining the temperature of flames it is manifest that the finest usable wire must be employed, in order to reduce the error from conduction. Test experiments also showed that no part of the thermo-couple must project beyond the flame; if it did a considerable diminution in the recorded temperature took place.

For these reasons it was manifestly best to use the finest wire which could be employed without the risk of fusing at the temperatures existing in the flames to be tested. All temperatures recorded in this paper were made with wire 0.011 inch in diameter, the twist being as short as possible; so that it is probable, although the temperatures may be from 100° to 200° too low, that the results are strictly comparable.

Experiments which I have lately made with pure acetylene, prepared by the action of water upon calcic carbide, shows it to be the most powerful illuminant to be found amongst the gaseous hydrocarbons, as when burned in a small flat flame burner under the most suitable pressure, and its illuminating power calculated to a flow of 5 cubic feet an hour, its value is equal to about 240 candles. The color of the flame is pure white—an ethylene flame beside it looks yellow and dull. The purity of the light at once suggests a very high condition of incandescence in the particles of carbon present in the flame. On taking the temperatures of the various portions of the flame and comparing these with the temperatures obtained in the same way with the ethylene flame and a coal gas flame of the same size, the following results are obtained:

Portion of Flame.	Acetylene.	Ethylene.	Coal Gas.
Non-luminous zone	459° C.	952° C.	1,023° C.
Commencement of luminosity	1,411 "	1,340 "	1,658 "
Near top of luminous zone	1,517 "	1,865 "	2,116 "

The illuminating value of the gases, calculated to a flow of 5 cubic feet an hour in the burners best suited for their consumption, are:

Acetylene	240.0
Ethylene	68.5
Coal gas	16.8

If all were compared when burning from flat flame burners of the same size as those in which the temperatures were determined, the results, when calculated to a consumption of 5 cubic feet an hour, would be:

Acetylene	211.0
Ethylene	31.5
Coal gas	nil.

Here, then, we have the anomaly of three gases which not only do not conform to the preconceived expectation, but which have their ratio of temperature and illuminating value directly opposed to each other.

In the cases of the acetylene and ethylene, moreover, the molecules contain the same number of atoms of carbon, and yet we obtain so enormous a discrepancy in their illuminating value.

The fact that there is no apparent relation existing between the temperature of the flame, or the probable number of carbon particles contained in it, and its illuminating value, at once suggests that the luminosity must be, in great part, governed by some thermo chemical changes taking place in the flame itself, and which do not, of necessity, affect the average temperature of the flame to any great degree.

The researches of Hittorf (Wied. Ann., Vol. VII.) and Siemens, showing that air, steam, and the oxides of carbon, even when heated to temperatures above those existing in luminous hydrocarbon flames, are perfectly non-luminous, and the fact that the bunsen flame, when supplied with sufficient air, has a temperature exceeding 1,800° C. in its hottest part, and yet emits no light, show us that it is exceedingly unlikely that any interactions leading to luminosity take place amongst these ordinary flame gases.

Acetylene Solves the Problem.—The fact that most of the unsaturated hydrocarbons in the flame are converted into acetylene before luminosity commences naturally draws one's attention to this body, and the fact that it is highly endothermic at once suggests the idea that it may be the liberation of heat during its decomposition that endows the carbon particles produced from it with an incandescence far higher than any which could be expected from the temperature of the flame.

Berthelot has calculated that the temperature developed by the detonation of acetylene at constant volume is no less than 6,220° C.; and if this be imparted at the moment of its liberation to the products of its decomposition, the incandescence of the carbon particles is at once explained. If luminosity be even partly due to this cause, the detonation of pure acetylene, first recorded by Berthelot, should develop light. In order to see if this were so, a thin glass tube, closed by a cork, had a detonator containing one-tenth of a gram of mercuric fulminate suspended in it by two copper wires, which were connected by a thin platinum wire in contact with the fulminate; on firing the detonator by the electric current the flash of the fulminate was found to emit but a feeble light.

The same charge was fired in a similar tube filled with pure acetylene collected over mercury, the result being a flash of intense white light and the shattering of the tube, the pieces of which were thickly coated with the carbon produced by the decomposition of the acetylene. Moreover, the small piece of white tissue paper used to contain the fulminate was only scorched at the points where the explosion of the fulminate had burst through it, showing that in the instantaneous decomposition which had taken place the intense heat which had been developed either was confined to the products of decomposition, or else had not had time to scorch the paper.

The experiment at first sight seemed conclusive evidence that it was the endothermic nature of the acetylene which, during its decomposition in the flame, endowed the particles of carbon with the necessary incandescence, but the objection presented itself that when exploding mixtures of oxygen and hydrogen in the eudiometer a distinctly luminous flash is produced. Although the light so obtained is feeble, as compared with the intensity of the white light produced by the detonation of the acetylene, still further proof is necessary before this action can be accepted as the prime factor in producing luminosity.

It is also manifest that it would not do to assume that the rapidity of the decomposition of the acetylene in a flame is nearly so great as when the undiluted gas is detonated, and the question arose as to whether it would be possible to obtain evidence as to acetylene, when exposed to heat alone, liberating carbon in a luminous condition.

Although the instantaneous liberation of heat on the decomposition of the gas by the detonation appears to confine the temperature to the products of its decomposition, it was to be expected that, on being decomposed by heat, and probably, therefore, at a slower rate, the increase in temperature might be detected. To try this, pure acetylene was passed through a platinum tube 2 mm. in diameter and 40 cm. long, in which the Le Chatelier thermo-couple was arranged as follows: The two wires are twisted together for a length of 3 mm., and the wires on either side of the twist are then passed through thin glass tubes, which are fused on to them. Having been in this way coated with glass, so that only the twist is exposed, they are passed through the platinum tube, the glass insulating the wire from the metal of the tube and also keeping the thermo-junction in such a position that it registers the temperature of the gas in the tube, not that of the wall of the tube. To each end of the platinum tube, glass T-pieces are fitted, down the stems of which the wires pass to mercury seals; from the metal seals, conducting wires lead to the resistance coils, the key, and a reflecting galvanometer.

A steady flow of acetylene was allowed to pass through the tube, and was led into the water at the other end. The tube was slowly and carefully heated for about 4 inches of its length. As the temperature reached 700° C., white vapors began to flow from the tube, and these, as the temperature rose, increased in quantity. The source of heat was so regulated that the temperature rose about 10° per minute, but almost immediately 800° C. was passed the galvanometer registered a sudden leap up in temperature to about 1,000° C., whilst finely-divided carbon poured from the tube. This seemed to indicate that 800° was about the temperature at which pure acetylene broke up into its constituents.

An experiment was now made to see if this developed incandescence in the liberated carbon. A small glass combustion tube was well supported, and heated to the highest temperature attainable with one of Fletcher's big blow pipes whilst pure acetylene was slowly flowing through it, the heating not being commenced until the tube was filled with pure gas, all air being thoroughly rinsed out. As the temperature reached the softening point of the glass, the acetylene apparently burst

into a lurid flame at the point where it entered the zone of heat, and clouds of carbon swept forwards through the tube; but, although the carbon particles had to traverse an inch or more of tube more highly heated than the point of entering the hot zone, it was only at this latter point that the luminosity was developed, proving beyond doubt that it was the heat evolved by the decomposition, and not the external heating, which caused the carbon particles to emit light.

Effect of Diluents upon Acetylene.—If it is the decomposition of the molecule of acetylene which develops the heat which is the cause of the incandescence of the carbon particles, then, if acetylene could be burned without decomposition, a non-luminous flame should be produced. It is conceivable that this might be done by so diluting the acetylene that it would require a much higher temperature to break it up.

It was Heumann who showed (Liebig's Ann., Vol. CLXXXIII, pt. I) that hydrocarbon gases may burn with luminous flames, *i. e.*, with separation of carbon in the flame, or with non-luminous flames, *i. e.*, without any separation of carbon, and that the maintenance of a high temperature is an essential condition of luminosity—a flame the temperature of which has been lowered by any means being no longer able to bring about the required separation of carbon. He also points out that "combustible matter, when diluted with indifferent gases, requires to be maintained at a higher temperature, in order that it may burn with a luminous flame, than when it is undiluted with such gases."

Dr. Percy Frankland, in his researches on the effect of diluents upon the illuminating value of hydrocarbons, showed that ethylene, which was capable of developing a light of 68.5-candle power when burned by itself, became non-luminous when diluted with about:

Hydrogen	90 per cent.
Carbon monoxide.....	80 "
Carbon dioxide.....	60 "
Nitrogen.....	87 "

Results which will show that excessive dilution by inert gases destroy luminosity. (Chem. Soc. Jour., Vol. XLV.)

In order to see if dilution had the same effect upon acetylene, experiments were made by diluting it with pure hydrogen. The gases were mixed over water, the proportion of acetylene actually present in the gas being determined by analysis at the burner. Although the water in both holder and meter was, as far as possible, saturated with the gas, yet, as the analyses show, this precaution was an important one.

Composition of Mixture.				Illuminating Value of Mixture per 5 c.c. when Burned in 00 Bray.
Made in Holder.		At Burner.		
Hydrogen.	Acetylene.	Hydrogen.	Acetylene.	
90	10	90.5	9.5	nil.
80	20	81.5	18.5	1.8
70	30	65.5	34.5	14.0
50	50	43.5	56.5	87.0

This shows that dilution with between 80 and 90 per cent. of hydrogen rendered the acetylene non-luminous when the mixture was burned from a burner suitable for the higher values of gas.

In order to determine the point at which luminosity was destroyed when consuming the mixture in a burner suited to develop the light from a gas of low illuminating power, the experiment was repeated, using a 3-inch flame burning from the London Argand, and also from a No. 4 Bray union jet, the latter being employed, because it is difficult to determine the temperature in the Argand flame.

Analysis of Mixture.		Illuminating Value per 5 Cubic Feet.	
Hydrogen.	Acetylene.	Argand.	No. 4 Bray.
92	8	Not measurable.	
91	9	Not measurable.	
88.5	14.5	4.1	1.7

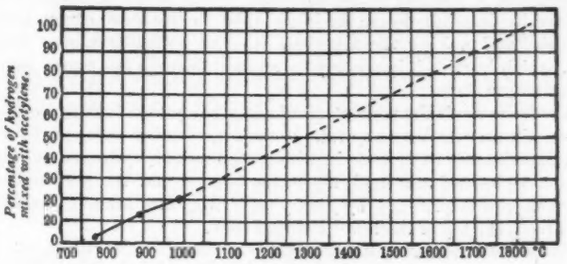
So that luminosity would be destroyed in the Argand by dilution with about 90 per cent. hydrogen, and in the No. 4 Bray with about 88 per cent.

The next point to be determined was whether the destruction of luminosity in the diluted acetylene flame was in reality due to dilution, rendering it necessary to employ a higher temperature for the decomposition of the acetylene, or to other causes.

In order to do this a tube made of specially infusible glass 4 mm. in diameter was taken, and the Le Chatelier thermo-couple was fitted into it in the same way as before, used with the platinum tube. All air having been rinsed out by a current of the mixture to be experimented with, the gas was allowed to pass at a steady rate of flow through the tube, the point at which the thermo-couple was situated being steadily heated by the Fletcher blowpipe, whilst the temperature recorded on the scale was noted the moment that incandescent liberation of carbon commenced.

Percentage Composition of Gas.		Temperature Necessary to Cause Deposition of Carbon with Luminosity.
Acetylene,	Hydrogen.	
100	0	780° C.
90	10	896° C.
80	20	1,000° C.

It was found impossible to obtain a glass tube which would stand temperatures higher than this; but on plotting out the points so obtained, and which give a fairly straight line, it is seen that even if the increase in temperature only continues for increased dilution, in the same ratio as shown in the experimental determination, which is extremely unlikely, the reason of the destruction of luminosity in highly diluted hydrocarbon gases is at once explained, as an increase of each 10 per



Temperature required to decompose acetylene with separation of luminous carbon.

Fig. 1.

cent. in the dilution would necessitate an increase of 100° C. in the temperature of the flame, and with 90 per cent. dilution a temperature of over 1,700° C. would be required to bring about decomposition.

My reason for believing that it is highly improbable that when dilution is great it only requires the same increment in temperature to bring about decomposition as when the dilution is small, is that in all the work I have done on the effect of diluents upon luminosity, and also in Professor Percy Frankland's researches upon the same subject, dilution with hydrogen and carbon monoxide acts regularly, and decreases the value of the illuminant in a direct ratio down to about 50 per cent., whilst when the degree of dilution exceeds 60 per cent. a rapid falling away in the luminosity takes place; a fact which, I think, points clearly to a regular pro rata rise of temperature being needed for increase in dilution up to between 50 and 60 per cent., whilst higher degrees of dilution need a far greater rise of temperature in order to bring about decomposition.

Moreover, it would be manifestly incorrect to look upon the percentage of acetylene present in the gas issuing from the burner as being any guide to the degree of dilution existing at the point at which luminosity commences. As the two small streams of gas issuing from the holes in the union jet meet and splay themselves out into the flat flame, they draw in with them a considerable proportion of air, the quantity being governed by the pressure of the gas at the burner. This can be clearly seen by the fact that a high value gas which burns from a union-jet burner of a given size with a smoky flame, under a gas pressure of half an inch of water, will burn with a bright, smokeless and rigid flame, of greatly increased illuminating value, when the pressure is raised to 2 inches, whilst an ordinary coal gas of 16-candle value must be burned from a flat-flame burner at a pressure of about 0.75 inch if the best results are to be obtained, the increase in air drawn in, if the pressure rises to a much higher degree, diminishing the illuminating value.

Then, again, the area of non-luminous combustion in a mixture of gases like coal gas means that some at least of the hydrocarbons are consumed before the required temperature for their decomposition is reached, whilst the products of combustion formed in the lower part of the flame are mixed with the flame gases, partly by diffusion and partly by being drawn into it by the upward rush.

When a simple hydrocarbon like ethylene or acetylene is burned alone, the whole of the heat required to bring about the decomposition has to be generated by the combustion, without decomposition, of a considerable proportion of the hydrocarbon, and this means considerable dilution at the spot where the luminosity commences, so that at the top of the non-luminous zone of an acetylene flame there is only some 14 or 15 per cent. of acetylene present, diluted with nitrogen, hydrogen, water vapor and the oxides of carbon. With a mixture of 10 per cent. acetylene and 90 per cent. hydrogen in some cases, little or no acetylene could be found at the top of the inner zone of the flame, it either having diffused

with the hydrogen and been consumed, or polymerised to other compounds.

It is manifest that the luminosity of a flame will be governed, not by the percentage of acetylene in the gas, but by the percentage at the point at which the temperature is sufficiently high to bring about decomposition.

If, instead of making a mixture of 90 per cent. hydrogen and 10 per cent acetylene, the hydrogen is burned at the end of an open platinum tube which has a fine platinum tube passing up the center to the top of the inner zone of the flame, and if the acetylene be passed into the flame at the rate of one volume for every ten of the hydrogen, not only do we obtain an intensely luminous, but a very smoky flame. In this experiment the gases were issuing from their respective tubes at the same pressure, but the small tube soon choked from deposited carbon, and it was found that the same results could be equally well attained by drawing down the inner tube to the level of the hydrogen tube, and making the acetylene issue at a slightly higher rate of flow, which hurried it in a compact stream through the inner zone of the hydrogen flame.

In order to see if the percentage of acetylene present at the top of the non-luminous zone bore any ratio to the illuminating value of the mixture, experiments were made in which mixtures of hydrogen and acetylene were burned at a small flat-flame burner, and the percentage of acetylene was determined by gently aspirating out some of the flame gases from the top of the non-luminous zone.

Analysis of mixture used.		Acetylene at top of non-luminous zone.	Illuminating value of flame for 5 cubic feet.
Hydrogen.	Acetylene.		
65.5	34.5	3.72	14.0
43.5	56.5	8.42	87.0
0.0	100.0	14.95	240.0

On plotting out these results, they certainly seem to point to the fact that, with flames of the same size burning from the same burner, the

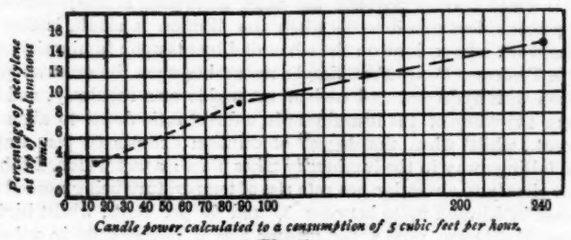


Fig. 2.

light emitted by the flame is directly proportioned to the percentage of acetylene present at the top of the non-luminous zone of the flame, provided always that the temperature is sufficiently high to complete the decomposition of the acetylene.

It is perfectly possible for the temperature of a flame to be so little above the point necessary to decompose the diluted acetylene that, whilst some decomposes and renders the flame faintly luminous, the larger portion burns without decomposition. A good example of this is to be found in the combustion of alcohol, the flame of which contains as much acetylene as is to be found in a good coal gas flame, but which is practically almost non-luminous. If alcohol be ignited in a small dish, it burns with a faintly-luminous flame, and if a bell-jar is placed over it some of the products of combustion mingling with the flame still further cool it and render it non-luminous; but if now a stream of oxygen be introduced under the bell-jar the temperature is at once increased and the flame becomes highly luminous, whilst a cold porcelain vessel held in the flame is coated with soot.

In all the experiments in which light was developed in heated tubes by the decomposition of acetylene, the glow of the carbon was red and lurid, the light emitted being of the same character and appearance as that developed by the combustion of potassium in carbon dioxide, and entirely lacking the pure white incandescence of the acetylene flame as burned from a flat-flame burner.

This may be due to the fact that in the open flame the temperature of the carbon particles is, presumably, due to three sources of heat:

A. Heat derived from the decomposition of the acetylene molecule.
B. Heat derived from the combustion of hydrogen, carbon monoxide, and some hydrocarbons in the flame.
C. Heat derived from the combustion of the carbon particles themselves.

In the tube experiments the heat of the walls of the tube and the heat of decomposition alone are acting; and it is evident that the intensity of the heat finding its way through the walls of the tube will be very different to that exercised by the walls of burning gas which enclose the luminous portion of the flame. There can be but little doubt that the temperature of the carbon particles will vary enormously with the rate at which the acetylene decomposes, as the more quickly the action takes place the greater will be the localizing action upon the heat evolved, and the higher the incandescence of the carbon particles. That this is so seems certain from the whiteness of the flash of light emitted when the acetylene is detonated.

Endothermicity and Combustion Heat.—Experiments were made in order to, if possible, gain an idea as to how much of the incandescence of the carbon particles was due to the endothermicity of the decomposing acetylene, and how much to the action of heat and combustion on the carbon particles after formation. In order to do this a non-luminous flat flame of large size was desired, and was obtained by using coal gas de-illuminated by slowly passing it through bromine, well washing with sodic hydrate solution and water, and then passing it through strong sulphuric acid, the gas so treated having an illuminating value of 1.2 candle for 5 cubic feet when burned in the London argand at such a rate as to give a 3-inch flame, whilst in a fish-tail burner it gave a non-luminous flame. This gas gave, on analysis, the following percentage composition:

Carbon dioxide	0.00
Unsaturated hydrocarbons	0.00
Carbon monoxide	5.50
Saturated hydrocarbons	33.28
Hydrogen	55.25
Nitrogen	5.49
Oxygen	0.48
	100.00

so that its combustion would give practically the same temperature and flame reactions as those in an ordinary gas flame.

A very fine platinum tube was now obtained, closed at one end, and with five minute holes bored in a line close to the sealed end. This having been so arranged that the holes were buried in the flame just at the top of the inner zone, acetylene was allowed to flow gently through them into the flame. At the points where the acetylene issued into a flame small areas of intense luminosity were produced, whilst the liberated carbon streaming up between the flame walls of the upper zone produced dull red bands of very low luminosity. It may be suggested that the carbon particles supplied in this way to the flame may have agglomerated and formed masses larger than those produced in the ordinary way, but I do not think that was the case, as the particles were completely consumed and no smoke escaped from the crown of the flame, whereas, if a flat flame is interfered with in such a way as to cause the carbon particles to roll themselves together, smoking of the flame is produced.

I think the inference to be drawn from this experiment undoubtedly is that it is the heat of decomposition which gives the high incandescence and light-emitting value to the carbon particles, and that the temperature of the combustion of the other flame gases and, finally, of the carbon itself, plays but a secondary part.

Cyanogen Analogy Considered.—In considering these results, it seems remarkable, if acetylene owes its power of rendering hydrocarbon flames luminous to its high endothermic properties, that cyanogen, which is still more endothermic, should burn under all conditions that have at present been tried with a non-luminous flame:

		Heat of Formation.
Acetylene	C_2H_2	—47,770
Cyanogen	C_2N_2	—65,700

It is clear that if the rapidity of decomposition localizes the heat evolved to the products of decomposition, and that renders the liberated carbon particles incandescent, whilst the hydrogen plays at best a very subsidiary part, it ought not to matter whether it be hydrogen or nitrogen which is combined with the carbon.

Berthlot showed that cyanogen, like acetylene, could be detonated by a small charge of mercuric fulminate, but he notes that the test is not always successful; which points to the decomposition of this body requiring a greater expenditure of energy to break up the molecule than is the case with acetylene. And known facts would lead us to expect that this would be the case, as although exothermic compounds become less and less stable with rise of temperature, endothermic bodies, on the other hand, become more stable, and the endothermicity of cyanogen being greater than that of acetylene, would lead one to expect that temperatures which would decompose acetylene would have no effect on

cyanogen, and that, as during the combustion of cyanogen, the liberation of nitrogen would probably have a diluting and cooling action, the cyanogen would burn directly without liberating any carbon which would emit light.

In order to see if the temperature of the cyanogen flame, when burned from an ordinary flat-flame burner, differed much from that of hydrocarbons when consumed in a flame of the same size and kind, the temperatures were experimentally determined by the same method, and in the same parts of the flame, as had before been employed with acetylene, ethylene and coal gas.

Portion of the flame.	Temperature.
Center of inner zone	1,377° C.
Top of inner zone	2,085° C.
Near top of outer zone	1,645° C.

This shows that the cyanogen flame was actually hotter than the acetylene and ethylene flames, and about the same as the coal-gas flame, but that the heat was differently distributed, the inner zone being far hotter than in the other gases, whilst the maximum temperature of the flame was at the apex of the inner zone, instead of being near the top of the flame.

An experiment was now made to ascertain if it was possible to decompose cyanogen with luminous deposition of carbon, by passing it through a hard glass tube, heated by means of the blow-pipe; but at the highest temperature attainable no trace of any deposition of carbon was found, showing how far more stable cyanogen is under the influence of high temperatures than acetylene.

The structure and characteristic appearance of the cyanogen flame have been explained by Smithells (Chemical Society Journal, 1894) and Dent, who conclude that the inner zone of peach-blossom tint is caused by the combustion of the cyanogen to carbon monoxide and nitrogen, whilst the outer blue cone is formed by the oxidation of the monoxide to dioxide; the green fringe to the outer cone being attributed to the presence of small quantities of oxides of nitrogen. If this explanation be accepted, it is clear that we could not obtain luminosity in the portion of the flame immediately above the inner zone, as all cyanogen has been destroyed without decomposition before that point is reached. It is conceivable, however, although no luminosity can be detected in a cyanogen flame, and although the temperature which can be obtained in a glass tube is insufficient to break up the compound with luminous separation of carbon, that if cyanogen could be heated to a considerably higher temperature, it might be possible to decompose it in such a way as to develop luminosity.

In order to try this point, a hydrogen flame was burned from the end of an open platinum tube 9 mm. in diameter, and a thin platinum tube 2.5 mm. in diameter was passed up through the broad tube to the apex of the inner zone, and a slow stream of cyanogen was admitted; with the result that the flame at once became luminous; and on surrounding the hydrogen flame with an atmosphere of oxygen, to increase the temperature, the luminosity was considerably increased.

This experiment at once explains the cause of the non-luminosity of the cyanogen flame. It shows that it is purely a question of temperature; and the probabilities are that, burned in a flame which gave sufficient heat to rapidly decompose it, nearly as high an illuminating value as that of acetylene would be obtained from cyanogen.

I think the explanation of the apparent anomaly of the cyanogen flame having a higher temperature than the acetylene and ethylene flames is to be found in the fact that the molecules of cyanogen are consumed without previous decomposition, so that the heat absorbed during the formation of cyanogen is added to the heat of combustion, and raises the average temperature of the flame, whereas with acetylene the instantaneous decomposition of the molecule before combustion confines the heat evolved to the liberated products, and the average temperature of the flame is but little more than the heat of combustion.

Ratio between Illuminating Value and Heat of Formation.—If the luminosity of a hydrocarbon flame is principally due to the localization, during intensely rapid decomposition, of the heat of formation in the products, the illuminating values of such hydrocarbon gases as contain 2 atoms of carbon in the molecule should bear a simple ratio to their heat of formation. The gaseous hydrocarbons are—

Hydrocarbon.	Composition.	Heat of Formation at Constant Pressure.
Ethane	C_2H_6	+25,670
Ethylene	C_2H_4	— 8,000
Acetylene	C_2H_2	—47,770

And although they may undergo many changes in the flame, they will all ultimately be reduced to carbon and hydrogen again before the full luminosity of the flame is developed.

When the acetylene into which these hydrocarbons is converted by heat is decomposed, the action takes place with such enormous rapidity that one would expect the heat evolved to simply divide itself amongst the liberated atoms, so that the question of specific heat at high temperatures may be omitted.

With exothermic compounds like ethane considerable heat will have to be developed by its own combustion before it is converted into the acetylene which, by its decomposition, endows the flame with luminosity, and if we take the ethane and call its light-producing energy 1, we can then obtain a ratio of such energy for the other hydrocarbons available for distribution amongst the products of decomposition.

$$\text{Ethane} \ldots\ldots \frac{25{,}670}{25{,}670} = 1$$

$$\text{Ethylene} \ldots\ldots \frac{25{,}670 + 8{,}000}{25{,}670} = 1.31$$

$$\text{Acetylene} \ldots\ldots \frac{25{,}670 + 47{,}770}{25{,}670} = 2.86$$

These ratios must now be divided amongst the atoms liberated from the molecule at the moment of decomposition, and we thus obtain the ratio:

$$\begin{array}{ccccc} C_2H_6 & & C_2H_4 & & C_2H_2 \\ \frac{1}{8} & : & \frac{1.31}{6} & : & \frac{2.86}{4} \\ \text{or } 1 & : & 1.74 & : & 5.72 \end{array}$$

The determination of the illuminating value of a gas becomes more and more difficult the higher its illuminating value, owing to the cooling effect of the small burners that must, of necessity, be used in order to insure complete combustion. Dr. Percy Frankland (Chem. Soc. Jour., Vol. XLVII.) assigned the illuminating value of 35 candles to ethane, as the mean of four tests which varied considerably amongst themselves. Adopting his figure, the calculated illuminating values for the ethane, ethylene and acetylene would be:

	Illuminating Value.	
	Calculated.	Found.
Ethane	1 × 35 = 35	35
Ethylene	1.79 × 35 = 60.9	68.5
Acetylene	5.72 × 35 = 200.2	240

These figures are far nearer the experimental ones than could have been expected, considering the crude character of the calculation and insufficient data, which leads to omitting altogether such important factors as the amount of gas consumed to bring about the requisite temperature of decomposition, the specific heat of the products, and the thermal value of the change from gaseous to solid carbon; and they are of no value except as showing that a ratio does exist between heat of formation and illuminating value.

Methane is the only other gaseous hydrocarbon of which the heat of formation is known, it being + 21,750. As the molecule contains only 1 atom of carbon, 2 molecules have to be taken, and on calculating the probable illuminating value by the same method as was applied to the other hydrocarbons, we should have:

$$\frac{25{,}670 + \{25{,}670 - (21{,}750 \times 2)\}}{25{,}670} \times 35$$

$$\frac{}{10 \times \frac{1}{8}} = 8.4$$

The illuminating value as determined by Mr. Lewis T. Wright is 5.2; but here, again, we know by experiment that methane requires a very high temperature to bring about its conversion into acetylene and decomposition into carbon and hydrogen, and that to do this a large portion of the gas must be burned without decomposition.

Deductions.—The facts which I have sought to establish in this paper are:

1. That the luminosity of hydrocarbon flames is principally due to the localization of the heat of formation of acetylene in the carbon and hydrogen produced by its decomposition.

2. That such localization is produced by the rapidity of its decomposition, which varies with the temperature of the flame and the degree of dilution of the acetylene.

3. That the average temperature of the flame due to combustion would not be sufficient to produce the incandescence of the carbon particles within the flame.

In my paper on the action of heat upon ethylene, brought before the Royal Society this spring, I showed that the decomposition of ethylene into acetylene and simpler hydrocarbons was mainly due to the action of radiant heat, and was but little retarded by dilution, whilst I have shown in this paper that the acetylene so produced requires a consider-

able increase in temperature to bring about its decomposition when diluted.

It is possible with these data to give a fairly complete description of the actions which endow hydrocarbon flames with the power of emitting light. When the hydrocarbon gas leaves the jet at which it is being burned, those portions which come in contact with the air are consumed and form a wall of flame, which surrounds the issuing gas. The unburned gas, in its passage through the lower heated area of the flame, undergoes a number of chemical changes, brought about by the action of radiant heat emitted by the flame walls, the principal of which is the conversion of the hydrocarbons into acetylene, methane and hydrogen. The temperature of the flame quickly rises as the distance from the jet increases, and a portion of the flame is soon reached at which the heat is sufficiently intense to decompose the acetylene with a rapidity almost akin to detonation, and the heat of its formation, localized by the rapidity of its decomposition, raises the liberated carbon particles to incandescence, this giving the principal part of the luminosity to the flame; whilst these particles, heated by the combustion of the flame gases, still continue to glow, until finally themselves consumed, this external heating and final combustion adding slightly to the light emitted. Any unsaturated hydrocarbons which have escaped conversion into acetylene before luminosity commences, and also any methane which may be present on passing into the higher temperatures of the luminous zone, become converted there into acetylene, and being at once decomposed to carbon and hydrogen, increase the area of the light-giving portion of the flame.

My thanks are due to Mr. F. B. Grundy for the help he has given me in the work entailed by this paper.

Municipal Ownership of Public Corporations.

[By Mr. M. J. Francisco, in *Engineering Magazine*.]

Under our present systems of government the number of public officials is limited. In order to increase the list and enlarge the field for political corruption and power, a movement has been inaugurated demanding that governments (State, national and municipal) shall own and conduct all large commercial enterprises. If this plan could be carried out, the political offices to be filled would be multiplied a hundred thousand times. Then the great army of officials necessary to manage the railroads, telegraphs, telephones, express companies, and gas and electric lighting establishments, with hundreds of other branches of business that the advocates of municipal ownership would bring into the field of politics, would be changed at every election. This would place the country under the control of a vast army of office holders, whose only aim and object in life would be to retain their grasp upon office, regardless of the welfare or best interest of the municipality or nation. We are told that by this plan we should secure better results with less expense. What is the record of government, State and municipal ownership during the century that is closing?

In 1815 the net revenue of the English post office was about $8,000,000, and continued at this rate for 20 years. The people at this time were opposing this government monopoly and the tax to sustain it, as it appeared that the charge of 14 cents on each letter resulted in an expense for postage to some London houses amounting to $50,000 per year. To avoid this, private parties established a "penny post," but the government suppressed it, notwithstanding the number of letters sent by post was only as 1 to 10 sent by private means. This shows conclusively that the object of the English post was revenue and State surveillance, rather than a means of benefiting the masses.

The United States post office department is often cited as an illustration of the success of government ownership. Where would the benefits of the post office be, were it not for the aid of private corporations who transport and deliver the mails—the most important part of the whole process? This is not done by the government, but by private capital representing millions of money. The power of the post office department has been used as a vast political machine for rewarding friends, and the Boston *Transcript* states that "The month preceding the presidential election the greatest percentage of removals was made of any month for four years; whole lines were stripped of their experienced men, and the creatures of politicians were put in their places."

We will not consider the abuse of which the telegraph is capable for political purposes when in the hands of the party in power. It is conceded by all who have made it a study that private management renders better service, with lower rates and more accurate delivery, than can be obtained under government control.

A member of the New York Associated Press, one of the largest patrons of telegraph companies in the world, says that "the average time of transmission on the Western Union Company's lines is shorter than on any European system, and the number of errors made by American operators is much smaller than by European operators." Errors in this country average only about the fiftieth part of 1 per cent., but in Europe they are so common that the London *Times* said "the government telegraph was a failure," and that "it can hardly be doubted that, if the telegraphic wires of the country were in the hands of private companies and were administered by private enterprise, instead of being a government monopoly, the public would gain largely in rapidity, cheapness and extension of telegraphic communication."

Experience shows that in Europe and America State aid to railroads has resulted in immense losses. Most of the State railways in Austria, after an unsuccessful trial, were sold to private corporations for about half of their real cost. Mr. Kapp, in a letter in the *Nation*, referring to government ownership in Germany, says: "Henceforth it will be advisable for a railroad employee not to vote otherwise than in accordance with the political opinions of his chief. Railroad officers, post office and telegraph clerks, no longer dare to petition in their own names to the Reichstag, because they are threatened with punishment if they do so." In Italy the government took the system into its own hands, but, the gross receipts being continually less than the expenses, a special commission was appointed to investigate, and, after the most thorough and careful investigation ever made, it reported that "State railroads did not as a rule do so much for industry as private railroads; that, in general, their rates were higher, their facilities worse, their responsibility less, while the State railroad management was more apt to tax business than to foster it. Political considerations were brought into matters of railroad construction and management in a way which was disastrous alike to railroads and politics."

The plan of investing State funds in commercial adventures has been repeatedly tried in this country, and in every case has proved disastrous. Massachusetts invested $18,000,000 in railroads, and saved only $6,000,000. According to the State Treasurer's report, nearly one-half of the State debt of Massachusetts was caused by the State's connection with railroads.

The investment necessary to enable the government to own all the railroads, telegraphs, telephones and gas and electric lighting companies in the United States would amount to over $50,000,000,000 and require an army of over 10,000,000 employees. It is easy to foresee the effect upon business that would result from a change in this army at every election.

No one can deny the disastrous result upon any service of placing incompetent political tools in charge of it and frequently replacing them by others equally unfit. The history of this country under "the spoils system," with the wild scramble for office after every election, is positive proof that this plan would be carried out in all branches of service. The men who had become accustomed to the business would be turned out, and new politicians and bosses, utterly unacquainted with the work, would be appointed to take their places until another change, and so on, *ad infinitum*.

All the railways in the United States may not have been successful, but it is a fact beyond dispute that under private management the freight rates have steadily fallen in the interests of the people, and that this country commands the cheapest rates of any nation in the world.

The same conditions exist under municipal ownership that are found under government or State ownership, but on a smaller scale. Judge Dillon says: "Our large cities are encountering the perils of corruption and fraud on a gigantic scale, engendered by the large revenues and official patronage at their disposal, and the disinclination—often the steady refusal—of the substantial citizens to take a controlling part in the management of municipal affairs."

The public debt of the city of New York represents a vast aggregate of moneys wasted, embezzled, or misapplied, and the disclosures before the Lexow Committee ought to be sufficient to prevent for all time any enlargement or extension of municipal patronage and corruption. Philadelphia's corrupt management of its gas works, which involved the taxpayers in a loss of $3,500,000 in six years, is another illustration.

No wonder Judge Dillon said: "The Legislature should be prohibited from allowing municipal corporations to engage in extra municipal projects, or to incur debts or levy taxes for such purposes."

Committees, unacquainted with the business and with no practical experience in electrical affairs, are appointed by city councils to investigate and ascertain the cost of producing light in cities owning plants. This is done with a view of purchasing a plant. The worthlessness of such information and the unreliability of such investigations have been demonstrated times without number. They go to the officials of other cities, who have no knowledge of the science of electricity or its practical application, and whose information regarding the working of their own city's plant has been obtained from employees who owe their ap-

pointment to the influence of some political wire-puller whose interest it is to show a minimum of expense. Statements of this kind are used as authority regarding the cost of municipal lighting, notwithstanding the fact that they are discredited by men who have made it a study for years, have thoroughly tested every branch of the business, and are not beholden to a political boss for their position.

A party having a suit in the United States Supreme Court would not employ a carpenter to take charge of the case; neither would he go to a hod carrier for information regarding the running of the "Empire State Express;" but it is precisely by such a policy that advocates of municipal ownership govern their action. The representative of some manufacturer interviews the mayor or aldermen, furnishing a glowing account of a system by which electric lights can be produced for a mere trifle (provided they adopt his plan); then he refers them to other cities where the mayor and aldermen have been worked in the same way, knowing nothing whatever about the business or its practical application, having adopted it through the influence of some other party working either for pay or a "political pull." A few politicians are hired to boom the plan, and make speeches favoring it at the public meetings that are to be called. Garbled statements as to cost in other places, giving about half the expense, are provided. In this way the taxpayers are hoodwinked into voting for its adoption, and the sale is completed. The agent then starts for another city to repeat the same operation, and refers the aldermen in this new field to the last place which he has worked, informing them that, after a long and thorough investigation, his plans were adopted.

The fact that one city pays double the amount for the same grade and make of apparatus paid by another indicates that the cost of aldermanic influence was greater in the former than the latter city; but the taxpayer furnishes the money to pay for the plant, as well as all money spent in buying aldermen's votes.

The taxpayers in many places where municipal plants are found (furnishing lights to private parties at a price less than the actual cost of producing them) do not seem to realize that they make up this expense and loss to the city, in order to benefit a few citizens who use these private lights. A large proportion of the people in a city who do not use electric lights are taxed in this way for the benefit of a few who desire this luxury in their residences or places of business.

[To be Concluded.]

The Economical Lighting of Public and Private Buildings, Workshops, Etc.

[Abstract of a paper, read by Mr. Jno. West, M. Inst., C.E., and Past Prest. of The Gas Institute, before the Manchester Association of Engineers.]

The author began by remarking that, though the use of gas has become general, on account of its purity and cheapness for lighting and heating purposes, it is perfectly well known to the faculty that few people use the most efficient and most economical means for obtaining the maximum amount of light contained in the gas. Being convinced that there is a great loss of money to the community generally through the use of defective appliances, and that the best mode of consuming gas for obtaining efficiently and economically its highest illuminating power is still, by many, very imperfectly understood, he thought the Association would be carrying out their object if they investigated the cause of this, and explained the best-known principles of regulating and developing the most light from a given quantity of gas, by which means pecuniary and other advantages might be derived.

Mr. West then went on to say that gas is produced of different qualities throughout the United Kingdom, varying in illuminating power from 12 to 28 candles. In a large number of the provincial towns in England, it ranges from 12 to 15 candles; in London it is 16 candles; and in Manchester and other places nearer the cannel-fields, it ranges from 15 to 20 candles. In Scotland, where they are close to the cannel seams, it is made in some cases as high as 28 candles. He next explained the method by which the gas is tested; illustrating his remarks by means of a photometer which he had procured for the purpose. In this connection he mentioned that there are now 22 stations in and round London where the gas is daily tested by experts in order to ascertain if the companies are delivering to the consumers gas of the illuminating power and purity prescribed by act of Parliament.

The author then proceeded to show the different ways in which gas is consumed. Taking first of all the ordinary fishtail or batswing burner, he called attention to the fact that, using the same quality of gas, there was a great difference in the illuminating power. In one there were splendid yellow bands, giving forth innumerable rays of light; whereas in the other these bands were not so visible. He explained that the cause of the difference in the flames was a chemical question, and then proceeded to enlighten his audience on the phenomena of combustion and flame; demonstrating that the blue portion in the flame of a candle was in a gaseous state, but was not giving light. Passing on to the subject of burners he said that about thirteen years ago he obtained, for the purpose of comparison, a large number of burners that were being used by the ordinary consumers in Manchester, and tested them against several new burners that were obtainable. He found that the loss of illuminating power by the use of the old burners amounted in most cases to more than 30 per cent.; and he feared, from observations he frequently made, that from want of knowledge in many cases this loss was still going on.

The next section of the paper was devoted to a consideration of the results of the distillation of coal for the production of gas. Mr. West explained that in gas as supplied for consumption there are about nine different compound substances, which may be classed broadly into the light-giving and heat-giving portions. Measuring gas by volume, the light-giving constituents form a very small percentage of the whole bulk; the principal of which is made up of hydrogen. The light-giving compounds, he went on to show, consist entirely of carbon and hydrogen in a state of chemical union; both of them having an affinity for oxygen. He illustrated the effects of incomplete combustion, and described the chemical changes that occur when it is fairly complete. He pointed out that the brilliant yellow bands noticeable in luminous flames are due to the existence of a great multitude of infinitely small particles of carbon raised to a great heat. The important part played by heat in promoting the luminousity of gas flames was, he said, well exemplified in the extraordinary illuminating power of the various improved regenerator burners now upon the market.

The next matters touched upon were pressure and air supply, the regulation of which, the author pointed out, is very necessary in order to obtain the maximum amount of light contained in gas. This principle has been worked out in modern burners. He emphasized the fact that, if air is forced into a flame, it destroys its illuminating power; and, on the other hand, if gas is driven boisterously into the atmosphere, similar results follow. He showed that it is the different ways in which the gas issues from the various burners which cause the difference in the amount of light. In one case we have burners which require more pressure to force the gas through the smaller orifices; in another, the gas streams gently into the air, and quietly draws to itself the necessary amount of oxygen. In the latter condition we get the most light from the gas. In the standard Argand burner, the gas is allowed to issue from a number of small holes at a very low pressure; and the current and quantity of the air are regulated by the use of the chimney. If the supply of air is not sufficient to combine with the quantity of gas issuing from the burner, the oxygen combines with the hydrogen and such of the carbon as it is equal to. In this case, the remaining particles of carbon leave the upper part of the flame in the form of smoke; and it is proved that all burners give their maximum amount of light relatively to the quantity of gas consumed when the flame is just on the point of smoking. With regard to flat-flame burners, he explained that the draught or inflow of air upon the flame depends greatly upon the velocity at which the gas issues from the burner —in fact, it is the chief regulator of the air supply. Every flame, by its heat, produces an upward current, which draws into its sides the surrounding atmosphere; and the greater the draught made by the flame, the more air is drawn into it—the result being that there is an excess of oxygen, which quickly destroys the solid particles of carbon in the gas, instead of allowing them as in the Argand and proper burners, to remain in a state of suspension for a short time. Mr. West eulogized the labors of Mr. Sugg in connection with the improvement of burners. This gentleman had, he said, been the first to produce in this country an Argand burner constructed upon scientific principles. He had likewise greatly improved the batswing form; and had successfully introduced governors with flexible diaphragms to two burners used for domestic purposes.

Having briefly explained some of the laws and rules necessary to be observed in the economical consumption of gas, Mr. West proceeded to demonstrate, with apparatus which had been for the most part lent by Mr. Sugg, the difference between the old and defective burners and those of more modern construction. We give this part of the paper practically in full: On this meter we have burners attached; and by the observation of one minute you can ascertain the quantity of gas they will consume per hour. We find that the consumption of a No. 5 fishtail burner, without any obstruction or regulator attached to it (so that any variation in the mains will affect it), ranges from 3 to 6.5 cubic feet per hour. It is now consuming at the rate of 5 cubic feet per

hour, and gives a light only equal to about 12 sperm candles. If we increase the pressure, I can pass more gas through it without materially raising the illuminating power. These burners have holes pierced at the top at right angles. The streams of gas issuing through each of the orifices impinge one against the other and produce the shape of the flame. You will note that the interior of the flame is very blue compared with the batswing burner attached to the same meter, which flame is thicker and more brilliant, and is producing a light, with the same consumption of gas, equal to about 20 candles with the gas we are now using.

In the one case the gas is driven boisterously upwards, and more air is drawn into it, which prevents the particles of carbon being sufficiently heated to develop the light it contains; while the gas issuing from the other burners is regulated so that those particles remain in suspension for a short time, until they get into a high state of incandescence, and hence the increase in the illuminating power.

We will next come to the regenerator kind of burners of Siemens, Sugg, Wenham and others. In their arrangement, both the air and the gas are very highly heated before combustion; the result being that a better light can be obtained with from one-half to one-third the quantity of gas, according to the size and kind of burners used, than can be obtained from the ordinary burners. The small regenerator lamp I am using consumes about 3 cubic feet of gas per hour, and gives a light equal to 20 candles; and the larger lamps in the building give considerally more light per cubic foot of gas used than the smaller lamps. These burners with shades are used with great advantage for private residences, if fixed near the ceiling, for the combined object of giving light and for ventilating.

We now come to that form of the incandescent method of gas lighting invented by Dr. Carl Auer von Welsbach. By this system the gas flame is utilized as a heating, instead of lighting, medium. The gas is supplied through a special form of atmospheric or Bunsen burner. The flame thus produced is non-illuminant; the object being to raise to a high state of incandescence the hood or mantle which is suspended over the flame, and which we are told is made from certain minerals found in the higher northern latitudes. The makers of these burners say that their most recent mantles for use with what they call their "C" size gas burners give a light of from 18 to 20-candle power per cubic foot of gas consumed, and that they give this light for 1,200 hours without diminution. They also claim that these "C" incandescent burners will give three times more light with half the gas than an Argand burner.

Having been asked especially to advise you as to the lighting of engineering workshops, I decided to make some experiments with these burners in one of our own turning and fitting shops. This shop is 142 feet long, with galleries all round, with a 10-ton traveling crane running from end to end. For lighting the shop it is necessary that the burners should be above the top of the crane, which is 23 feet from the floor. Until recently, it was lighted with four gas lights, with enameled reflectors, having eight No. 5 burners, in each, partially upon the regenerator principle, and these burners certainly lighted up the center of the shop, so that we could see to handle things satisfactorily with the crane, but did not give sufficient light for erecting purposes. We then obtained some of the "C" incandescent gas burners, and fitted six of them in a cluster as close as we could place them, and put over them reflectors 4 feet in diameter. We have three of these clusters, instead of four as formerly; and the light produced has been most gratifying. We can now do erecting in the center of the shop without the aid of any other auxiliary lights.

We have carefully tested both the old and new burners as to the quantity of gas consumed and the illuminating power; and I herewith append the results:

Average Results of Several Experiments.

	Candles.
Illuminating power of gas as recently tested at Plymouth with the "London" standard Argand burner, consuming at the rate of 5 cubic feet per hour	15.86
No. 5 Bray's fishtail burners out of cluster of eight, when consuming at the rate of 5 cubic feet per hour, tested against the standard burner, gave an illuminating power of	12.18
"C" size Welsbach incandescent burner— Tested against the same standard burner, the incandescent burner, consuming at the rate of 3.2 cubic feet per hour, gave an illuminating power of	60.00
Incandescent burner corrected to standard of 5 cubic feet per hour would give an illuminating power of	93.60

Comparison of Cost of Lighting.

	Candles.
With the old cluster of eight burners, the quantity of gas consumed per hour, when tested with a standard meter, was 33.47 cubic feet, which would give a total illuminating power of	81.53
With the new cluster of six "C" size incandescent burners, the quantity of gas consumed per hour, when tested with the same standard meter, was 18.65 cubic feet, which would give a total illuminating power of	349.70
	Per Cent.
Saving in gas by the incandescent burner =	44.20
Increase in illuminating power by the incandescent burner =	428.00

Old Cluster of Eight Burners.

Cost in cents for lighting for one hour (gas at 62½ cents per 1,000 cubic feet)	2.0080
Cost in cents per candle power hour	0.0246
First cost of cluster of eight and reflector	$5.37½

New Cluster of Six Incandescent Burners.

Cost in cents for lighting for one hour (gas at 62½ cents per 1,000 cubic feet)	1.1200
Cost in cents per candle power per hour	0.0032
First cost of cluster of six and reflector	$23.04

From these figures you will see that in future we shall only use about one-half the quantity of gas, and get more than four times the light.

The makers also claim for these incandescent burners that you can get the same light with them from 15 to 16 candle gas as you can from 20-candle gas; and I have some proof of this. This being the case, the question might be asked: "Why make 20-candle power gas where 15-candle will answer the purpose?" My reply to this will be that, when incandescent gas burners become general, it will be wise for the Legislature to reduce the standard, and so enable gas companies and corporations to dispense with cannel and other enrichers, and sell gas at a cheaper rate to the consumers. This system of lighting is very much used on the Continent, and is to be seen in use at all the railway stations from the Dutch frontier to Berlin. It is also making rapid strides in London and other places, both for public and private lighting. We have 16 of the new burners in our drawing office—being one to each draughtsman—and others in our general office. We find that the hygienic advantages are very great. By having suitable shades you reflect a very soft and beautiful light upon the drawing board, and I learn that our draughtsmen and clerks very much appreciate this new system of lighting.

The cost of this system of lighting is very small indeed when compared with electric lighting, as the following calculations will show:

Incandescent Electric Lighting.

A 16-candle power lamp in use 1,000 hours will absorb 60 units of electricity, at 12½ cents per Board of Trade unit	$7.50

Incandescent Gas Lighting.

An incandescent burner consuming 3 cubic feet of gas per hour, or 3,000 cubic feet in 1,000 hours, and giving a light equal to 60 candles, or fully three times that of the electric light, will cost—

With gas at Manchester, at 56 cents per 1,000 feet	$1.69
With gas at Maidstone, at 58 cents per 1,000 feet	1.75
With gas at Plymouth, at 43 cents per 1,000 feet	1.31

As to the arrangements for lighting public and private buildings, I advise that, in all cases of general lighting, you should hang or fix your chandeliers or pendants in the center of the building or room, as a great amount of light is absorbed on the walls when brackets are used. In private houses, where the number of burners in use fluctuates very materially, I recommend the attachment of regulators to each burner; and these are now so numerous and cheap that they are within the reach of every consumer. For large works and factories, where as a rule the whole of the shops or rooms are lighted simultaneously, a large governor fixed at the outlet of the meter is an advantage; but where the workshops or rooms are very large and at varying levels, it is advisable to have a governor fixed on each floor. By these means you can regulate the supply of gas to the burners to a very considerable extent. To make the light more perfect, however, it is necessary that you should use burners with checks inside them, or, what is far better, a small governor to each burner.

When I first came to Manchester, 14 years ago, the inferior types of

burners without regulators were in use. By order of the Gas Committee, I tested a great number of them, when it was found that a large proportion were only giving half the light contained in the gas. From that time governors were introduced and universally employed; and we now find that in the large lamps, with the larger burners, we get more light than we obtained from the standard Argand burner. This is on account of burning it in large volumes, which assists in heating the air round the flame; and the particles of carbon are in consequence heated to a higher state of incandescence. I have been told that, since the introduction of high-power burners, Manchester has, taken as a whole, become the best lighted city in Europe. For myself, I may say that I have not seen anything to surpass it.

In conclusion, I trust I have shown that the pecuniary and other advantages to be derived when gas is properly consumed are very great indeed. I hope that what I have laid before you may be of advantage to you individually, and that you will carry out the object of this Association by imparting to the community generally the information you have received; and then the writer of this paper will feel that he has been doubly repaid for the trouble he has taken.

In the discussion on the paper, Mr. H. Webb, referring to the statement that the illuminating power of gas varied from 12 to 20 candles, asked what would, in Mr. West's opinion, be the best candle power gas for the lighting requirements of a town. He said he understood that about 14-candle gas would be the most economical. He could speak with confidence as to the advantages of the Sugg burner for domestic lighting; but with reference to the incandescent light his experience had been very unsatisfactory, especially with regard to the mantles, which he found did not last more than about four weeks. This was due, he thought, to the expansion and contraction of the mantles making them leave the rim of the Argand burner, so that air made its way in and exercised an injurious effect.

Mr. Gendall said the incandescent light was equal to any for office work. He had tried it for upwards of 12 months.

Mr. J. Nasmith observed that, in his opinion, the problem as regards lighting was resolving itself into a question of getting some type of improved gas burner, or, failing that, of the electric light. Although the incandescent burner was unmistakably a very powerful light, he thought there was no doubt that, like other brilliant lights, it had the faculty of leaving dark corners. He had also found, like Mr. Webb, a drawing away at the bottom of the burners, in incandescent lighting; and there was a considerable loss of power in the light after a few weeks' working. He had gone into the subject in connection with school lighting, and had come to the conclusion that what was wanted, if gas was to be adopted, was a system in which the light was not so much intense as diffused. They required a light that would carry. The incandescent burner might do for a drawing office, or other place where the light could be put just over the spot where it was needed; but for general purposes a more diffused light was required. He did not think gas managers would be wise to anchor themselves to the incandescent light. The need for improvement was, in his opinion, in the use of gas in other ways. With regard to the table given by Mr. West, he might point out that, though the first cost and the cost of burning per hour were given, the very large amount for maintenance had not been taken into account.

Mr. E. G. Constantine considered that the question of cost would, after all, be the chief reason that deterred people from adopting the electric light, especially for domestic purposes. He said he would like some information from Mr. West as to his experience with the mantles of Welsbach burners. With regard to the diffusion of light, this, he should think, would depend very largely upon the form and material of the reflector.

Mr. J. Schofield observed that the incandescent light was not a thing that could be placed under the care of an ordinary workman or domestic servant, owing to the caution needed in putting on the chimney, and generally fitting up the arrangement. He should also object to the incandescent light on hygienic grounds. With regard to diffusion, he did not think the intense white light would penetrate to the same distance as an ordinary light.

Mr. J. Sayers said he had had a number of incandescent lights in use since Christmas, and had not replaced a single mantle; in fact, he had never had any trouble with them.

Mr. Duff had found the Welsbach light much more economical than the old burners.

Mr. A. Saxon remarked that one great hindrance to gas lighting was the want of cleanliness; and he should await with interest Mr. West's reply to the question as to the mantles in incandescent lights.

Mr. Webb asked if Mr. West had experienced any inconvenience in connection with the incandescent light at his works, owing to the current of air caused by the crane travelling to and fro.

Mr. West, in replying upon the discussion, said with regard to the quality of the gas supplied to the public, there was considerable variation throughout the United Kingdom. In Scotland they had a richer gas, owing to cannel being so near at hand; but they did not always know how to burn it properly. There were more smoky rooms in that country than in England. He himself thought gas of 15 or 16-candle power the best for commercial purposes. With respect to the incandescent light, he had not found any inconvenience on account of the travelling crane moving about. As to the mantles, he had only replaced four during the five months' working with the light. They had the Stott-Thorp burners in the shop previous to the introduction of the Welsbach burners. In the new arrangement, the reflectors were placed at such an angle that there were no shadows in the place. They had no pilot lights in use in the shop referred to. There was certainly a great deal in the fixing of the mantles, as to their stability. As first made, they were very fragile; but they were now much stronger than formerly. With regard to the hygienic aspect of the question, the less gas they used for the same light, the fewer products of combustion there would be to make the atmosphere unhealthy. He thought it would be better to considerably reduce the standard of gas in Scotland, and also to lower it a candle or two in Manchester, providing the cost were reduced proportionately.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE plants of the Lincoln (Ills.) Gas and Electric Company have been taken over by Mr. F. M. Mills, of Des Moines, Iowa, who represented the proprietors of the Lincoln Water, Light and Power Company in the transaction.

WE understand that the consolidation of the gas interests of Newark, N. J., will be completed before the time limit named in the agreement, which was set in the latter for October 1st.

MR. G. L. NICHOLSON has been elected to fill a vacancy in the Board of Directors of the Georgetown (D. C.) Gas Light Company. Mr. Nicholson is Manager of the Chesapeake and Ohio Canal Company.

AT the annual meeting of the Ann Arbor (Mich.) Gas Company the officers chosen were: President, E. D. Kinne; Secretary, Treasurer and Superintendent, Henry W. Douglas. The gain in the Company's sendout for the twelvemonth was almost 10½ per cent.

WE regret to announce the death of Mr. John Nix, for many years a Trustee in the Hempstead (L. I.) Gas Company. His death, which was very sudden, occurred in Charleston, S. C,, on the 9th inst., and the funeral services were celebrated at the Nostrand Avenue Methodist Episcopal Church, Brooklyn, N. Y., on the 14th inst. He was in his 71st year.

AT the annual meeting of the East Albany (N. Y.) Gas Light Company the officers chosen were: Directors, James H. Miller, F. Chamberlain, F. A. Sabbaton, Smith Briggs and H. A. Brooke; President, F. A. Sabbaton; Secretary, Frank Chamberlain; Treasurer, James H. Miller.

THE Louisville (Ky.) Gas Saving Company has been incorporated by Messrs. C. H. Dickson, Irwin Dugan and James S. Buchanan. It is capitalized in $4,000.

THE Cambridge (Mass.) Gas Light Company will construct a new purifying house on its Third street site. The dimensions of the building will be 100 feet by 60 feet.

THE Mayor of Philadelphia thus refers to the proposition for the sale of the city gas works to private owners in his annual message: "Changes in the direction of improvements will necessarily require a great outlay of money, but the returns will amply repay every judicious expenditure. The works should never pass from the absolute control and ownership of the city; the plant is too valuable, and history shows that wherever such a property passes into private hands, it in time becomes an extortionate monopoly. If new and improved methods of production be introduced, and the manufacture and sale of gas conducted on business principles, I have no doubt but that a large revenue would result to the city. I mainly base this judgment on the hints frequently given in the anxiety and desire of certain syndicates and corporations in the past to obtain control of said gas works."

THE Mayor also urges the establishment of an electric lighting plant to be operated on municipal account.

THE proprietors of the Chattanooga (Tenn.) Gas Light Company are much satisfied over the course of lectures on cooking by gas recently completed in that city, under their auspices, by Miss L. C. Andrews. The lectures were well attended, and Miss Andrews had no trouble in holding the attention of her audiences.

GAS is now being made at Excelsior Springs, Mo. The plant, which was fired up on the 3d inst., is said to represent an expenditure of $20,000.

AT the annual election of the Kenton (O.) Gas and Electric Company the Directors chosen were: L. Merriman, G. W. Rutledge, H. C. Koller, Jos. Timmons, M. C. McVitty, S. L. Hoge, J. A. Rogers, J. N. McCoy, W. S. Robinson, H. Price and T. Espy. The organization meeting will be held May 6th.

AT the annual meeting of the Decatur (Ills.) Gas Light and Coke Company the officers chosen were: Directors, B. K. Durfee, Frank Shlaudeman, L. Burrows, H. Shlaudeman, J. J. Peddecord, C. A. Ewing, W. C. Johns, Joseph Michi and John R. Farnum; President, H. Shlaudeman; Vice-President, Frank Shlaudeman; Secretary and Treasurer, B. K. Durfee; Supt., R. J. Stratton. The only change in the Directorate is shown in the election of Frank Shlaudeman to replace the late Mr. John K. Warren, who, at the time of his death, was also President of the Company. The Directors considered the advisability of making improvements on the manufacturing plant, and it was determined to increase the main system by placing some 6 miles of pipe.

As was noted in our last issue, three proposals, by as many projectors, were before the Council of Tampa, Fla., for the right to construct and operate a gas works in that city. The consideration of the proposals resulted in the acceptance of that submitted by Messrs. A. J. Boardman and P. O. Knight on behalf of the Tampa Gas Company, the main features of which are as follows: The Company to construct a plant equal to a daily output of 100,000 cubic feet, and to have the same in operation within 13 months from the date of the passage of the ordinance; the rate per 1,000 cubic feet to the city to be $2; when the output reaches 15,000,000 cubic feet per annum, the rate is to be $1.90; when the output reaches 25,000,000, the rate is to be $1.85; when the output exceeds 35,000,000, the rate is to be $1.75. City lamps (5-ft. burners) will be maintained on moonlight schedule at the rate of $24 each per year; on an all-night and every night schedule the rate is to be $30. To ordinary consumers the gross rate is to be $2.25 per 1,000, less 10 per cent. for prompt payment. Other concessions are to apply, based on amounts of gas used within named times. It is also stipulated that no other privilege at any time shall be given to any other Gas Company unless said Company shall agree to be bound by conditions at least as stringent as those here specified.

A CORRESPONDENT writing to us from the Hotel De Soto, Tampa, Fla., under date of the 15th inst., forwards the following respecting the move ment to establish a gas works there: *Dear* JOURNAL: There proves to be another Richmond in the field, in the person of Mr. A. J. Boardman, a second cousin of our friends, A. E. Boardman, of Macon, Ga., and Henry Boardman, of Bangor, Me. Mr. A. J. Boardman is also originally from the State of Maine, being a native of Calais. He is now, however, and has been for a number of years, a resident of Minneapolis, Minn., and is interested, with our mutual friend, Harvey Brown, in the Minneapolis Gas Company. Last week the final action of the City Council, of Tampa, granted to Mr. Boardman, Mr. P. O. Knight and Mr. Edward Manrara (of Tampa) a franchise to build and operate a gas works in the city of Tampa, and work will probably begin on Nov. 1st, next, when the "close season" for opening streets ends in this section. The local papers describe Mr. Boardman as "a natural gas well on the subject," so he will probably develop into a useful member of the gas fraternity. As there are two pretty strong electrical companies already in the field, one of which has water power galore, the struggle for existence will prove interesting, if nothing more. For once the dear public is welcoming a Gas Company as a deliverer from "oppression" in the lighting business. "Rah for gas!"

NOTHING will be done by the Springfield (Mass.) Gas Light Company towards piping the West Springfield district until well along in the summer.

THE officers chosen to control the affairs of the Union Illuminating Company (which corporation resulted from the amalgamation of the Union Electric Company and the Seattle Gas and Electric Company, of Seattle, Wash.), are: President, C. P. Stone; Vice-President, Maurice McMicken; Secretary, L. A. Turner; Treasurer, E. C. Kilbourne. Mr. Kilbourne is General Manager of the Company; Mr. John Mather is Superintendent of the gas department, and Mr. A. L. Hawley is in charge of the electrical division.

THE iron roof trusses and purlins for the new electric light station at Marblehead, Mass., have been furnished by the Berlin Iron Bridge Company, of East Berlin, Conn.

THE death of Mr. William F. Spotswood, for many years Treasurer of the Petersburg (Va.) Gas Light Company, occurred at Petersburg on the morning of the 12th inst. Deceased, who was in his 69th year, had been in the drug trade on his own account in Petersburg since 1858, had acted as Treasurer of the Petersburg Gas Light Company, as stated before, and figured in the political life of Petersburg very prominently, having been President of the City Council for several terms.

"AN interesting, and, to the inexperienced, exceedingly instructive series of lectures on cooking by gas, was opened in this city on the 5th inst., under the auspices of the Consolidated Gas Company, the lecture room being the handsome concert hall in the Metropolitan Opera House, and the presiding expert patroness was Mrs. Sarah T. Rorer. The initial subject treated was 'Small Breads,' and Mrs. Rorer demonstrated to the gratification of her hearers, and to the satisfaction no doubt of the Gas Company, a production upon a new construction of our grandmothers' art of bread making by the use of corn flour, to which was added the simpler and quicker method of evolving biscuits, gems, etc. She did not tell of the old woman 'who loved to make bread because it made her hands so clean,' but she did advise cleanliness, which, being next to godliness, was the fundamental principle underlying all successful and toothsome results in the culinary art; advocating hot gems and biscuits made and baked in 20 minutes in the gas oven, which food, she asserted, was far more digestible and nutritious than any form of potato food, in that the latter formed but a small per cent. of nerve power, of which power we all stand so much in need, and which the corn flour produced, baked in any form. As she mixed brains with gas it burned better. She is jovial, fat, fair—but I dare not say 40, lest I overguess; but round, rubicund and rosy she certainly is—beating her bowl of batter, bread or biscuits with the easy finish of an expert, and explaining the while; saying, among other things, that, at the World's Fair, she talked two hours each day for six months on 'Corn Flour,' and seemed not to exhaust the subject. She also alluded to the nickel-in-the-slot or prepayment gas meter, and gave it as her opinion that the machine would find favor with those who desired to use gas for cooking occasionally.—A. M. C."

THE second lecture or demonstration was made on the 12th inst., and our account thereof is from a local source: "Mrs. Rorer's dainty lunch was served in demonstration on the 12th inst. to almost as many women as the concert hall of the Metropolitan Opera House would hold. The menu was a tempting one for a spring luncheon and included orange soup; timbale of halibut, with cream sauce; fried potato balls; panned chicken, with mushrooms and rice. The lesson opened with a practical demonstration of the way to singe and dress a chicken. The chicken was split down the back, flattened and put into a platter, one-quarter of a tablespoonful of pepper sprinkled over it and one teaspoonful of salt strewed in the pan. Two tablespoonsful of water were then added to prevent burning, and the chicken placed in the oven for 30 minutes. The mushrooms to go with it were prepared by taking a half pound of mushrooms, peeling and cutting into small pieces; two ounces of butter were then added, and the whole covered and cooked slowly for 15 minutes. Then she added a half cup of milk to a half tablespoonful of flour and stirred over the fire until it was boiling, with a half teaspoonful of salt, a quarter teaspoonful of pepper and one tablespoonful of sherry. It was next stirred into the mushrooms and was ready to serve with the chicken. Mrs. Rorer said, would also be good with truffles, and incidentally told how truffles might be preserved. 'You buy them in the fall,' she said, 'and dip them one by one into melted suet and put away in a refrigerator, where they will keep all winter. Put them in warm water when ready to use, and they will come out perfectly fresh.' She chopped busily away on the fish for the timbales, while she told her guests how to make them. 'Take half pound of halibut, uncooked; remove, skin and chop fine with a silver knife. If you have a flour sieve, run the fish through it. Take one cup of bread crumbs and half cup of milk; put over the fire, boil and stir to a paste. Now this mixture, with the tendency of milk to scorch, is thoroughly cooked in a

paste without burning by being placed over an asbestos pad, remove from the fire, add the fish, half teaspoonful of salt, a dash of cayenne, and stir in carefully the well beaten whites of 5 eggs. Fill the mixture into small cups, stand in a pan of boiling water, cover with paper, and cook in a moderate oven 20 minutes. This will answer for all kinds of meat. For a rose lunch, red fish may be used instead of white, or shrimps may be used for the center, with shrimp sauce. This will make sufficient for 10 persons. For the orange soup, which is excellent for spring and summer, take one quart of strained orange juice, which will require about one dozen oranges. Put the juice over the fire and watch carefully until it comes to the steaming point—do not let it boil. Moisten two tablespoons of arrowroot with four tablespoons of water, stir into the orange juice, then add one-half a cup of sugar and turn out to cool. Serve in punch glasses, with perhaps a sliver of ice. Prepare the rice by taking one-half cup, turn out on a towel, look over carefully and rub starch off. Then throw into boiling water, having first placed a colander in the vessel, so that the rice may be lifted out. Boil until soft.' The lecture was interspersed with suggestions about the details of cooking and various minor directions which mean so much to the woman who wants to be a practical cook."

THE main features in the announcement by the Consolidated Gas Company of this series of lectures are appended: "In order to practically demonstrate the advantages of gas over any other form of fuel in cleanliness, in doing away with the handling of coal, ashes and kindling wood, and (with gas at the present low price) in economy, Mrs. Sarah T. Rorer, Principal of the Philadelphia Cooking School, has kindly consented to give a course of eight lectures, in three different parts of the city. During each lecture Mrs. Rorer will show the ease with which broiling, baking and roasting can be done on a gas range, and how a dinner for five persons can be prepared and cooked at a cost of a few cents. The gas ranges and stoves as now made can do any and every kind of work that can be done by coal stoves. The Company is renting gas stoves and ranges at the low price of $3 per annum and upwards. Samples of these and other gas consuming appliances will be on exhibition in the hall at the time of the lecture." The admission to these lectures is by invitation, which can be obtained on application to any of the Company's six office branches. It is worthy also of mention that each of these branches carries a full line of ranges, stoves, etc., and each of them is managed by a man who is thoroughly competent to explain the value of the goods in his keeping and to effect a sale wherever such conclusion is possible.

MR. JOHN STOUT, writing to us under date of April 15th, from Chicago, informs us that his connection with the American Meter Company, as its agent in Chicago, where he has represented it for many years, will terminate by agreement on May 1st. Mr. Stout is desirous of leasing a small gas plant, and is ready to investigate any offer on this account. He also desires to keep in touch with the trade on the same fraternal basis that has heretofore existed between them and him.

WE understand there is some likelihood of an amalgamation of interests of the Capital City Gas Company, of Des Moines, Ia., and the two local electric lighting concerns, one of which is virtually owned by the Gas Company. Perhaps this deal will simplify the lighting situation there, which, to say the least, has been (in fact is) decidedly mixed.

THE Orlando (Fla.) Gas Company's affairs are said to be improving since the same were put in a receiver's charge.

MESSRS. BYRNE, Leight and O'Hearn, of the Joint Water and Gas Committee, of the General Council of Louisville, Ky., recently discussed the question whether the city was obliged to pay interest on the deferred bills of the Louisville Gas Company for the public lighting of the city by means of arc lamps. In the discussion the Gas Company was represented by its President, Mr. Morris. The Committee claimed that under the contract with the city the Company could only collect for its arc electric service (there are 1,000 arcs in service, and the rate for all night and every night service is $84 per arc per annum) at the end of each year; but the Company objected, urging that another section of the public lighting service, under which gas lamps were maintained, provided for monthly payments for such service, and that the city admitted this was so by paying the bills therefor at the end of each month. President Morris insisted that if a twelvemonth credit should be allowed, the city necessarily occupied the position of any ordinary debtor. It was eventually determined that the city should refuse to pay the interest charges, when duly rendered by bill, which would form the basis for an action at law to recover by the Company.

Thawing Frozen Pipes with Electricity.

Mr. Edmunds, writing to the *Electrical Review* (London), informs that publication that he has been making some experiments lately with most complete success in what he thinks is a new and important application of electricity to domestic use. He, like many others, has suffered the inconvenience of having his gas and water service frozen during the late severe weather. It occurred to him that a resistance, suitably protected, might be introduced into those pipes which were most exposed and least easy of access with flame or hot water or other ordinary method of thawing. He had a special wire made in which the current was conducted through a highly resistant metal, insulated with a fireproof medium that was also a non-conductor of electricity. The whole was inclosed in a metal tube, which could be drawn down to make a compact wire or tube that was externally a conductor of heat, but not of electricity, thus preventing loss of current and electrolysis. The results were most satisfactory. This "thermic" wire was introduced into the waste pipe from a bath room at the north side of his house, which entered a fall pipe some 20 feet from the ground and which was easily frozen. The thermic wire was introduced from the outside. At night a small stream of water trickling down froze, forming an icicle some 12 inches long and 1¼ inches thick, completely locking the waste pipe. The thermic wire having been previously connected with Mr. Edmunds' electric light circuit, at 50 volts pressure, when current was turned on 4 amperes flowed through it, and in four minutes a complete thawing was effected and the waste service was cleared.

Cast Iron Girders.

The first application of cast iron girders to any extent, says the London *Architect*, was in the erection of floors of a fireproof mill constructed by Messrs. Philips & Lee, of Manchester, in 1801. The mills were of very considerable extent, being 142 feet long, 42 feet wide and 7 stories high. The floors were supported by a double row of columns situated 9 feet apart, extending the whole length of the building; resting on these were girders of the parabolic shape by Boulton & Watt, 14 feet long by 13½ inches deep, the space between them being spanned by brick arches resting on the bottom flanges of the girders. These arches were 9 inches deep at the springing, 7½ inches for a short distance on each side and half a brick, or 4½ inches, at the crown. From 1801 to 1824 very few alterations were introduced either in the section of the girders or in the designs of the floors themselves, and for more than 20 years the mills of Messrs. Philips & Lee were usually taken as a model for structures erected upon similar principles; nevertheless, during the interval just alluded to, the properties of cast iron were made the subject of many interesting researches by Tredgold, Fairbairn and others, the results of which had considerable influence in increasing the confidence of both engineers and architects in the value of that metal for building purposes. During that period many important improvements were also introduced in the art of casting, and girders of considerable dimensions became of frequent occurrence; among those we may mention the beams used to carry the floors of Buckingham Palace, many of which were from 35 to 36 feet in length.

In 1824 Mr. Rastrick recommended to Sir Robert Smirke (then Mr. Robert Smirke) cast iron girders for supporting the floors of the British Museum, in lieu of the trussed beams previously proposed by that gentleman. These girders, which were subsequently adopted, are 41 feet long, 3 feet 6 inches deep at the center and cast with an open web. Before being employed they were each tested with a dead weight of from 15 to 20 tons, placed at their center, and have since proved to be in all respects successful. It was about this period that Mr. Hodgkinson commenced his interesting experiments, among other results of which was the determining of the section combining the greatest strength with a minimum amount of metal. With a view of economizing metal by employing beams of equal strength throughout, it is usual to reduce gradually their sectional area from the center to the extremities; thus in girders employed for carrying floors the strain being in most cases equally distributed, the depth ought to vary in proportion to the ordinates of an ellipse, all the other dimensions remaining constant, and when it is advisable to preserve an equal depth throughout, the same effect can be obtained by increasing the breadth of the flanges in proportion to the ordinates of arcs of parabolas; this latter method has the advantage of economizing more metal and also of obtaining greater rigidity. When the sections of the beam at various points are similar, the depth of the beam and the breadth of the flanges are determined by curves of the cubical parabolic form. Theoretically, the variable dimensions would disappear altogether at the extremities of the girder, but in practice it is necessary to provide against the direct shearing strain and also to obtain a firm bedding on the supports; this can be done only by modifying the shape of the girder.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR - Jos. R. Thomas, C.E.
ASST. EDITOR - T. J. Cunningham.
MANAGER - C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY, VENTILATION, SANITARY IMPROVEMENT, AND GENERAL SCIENCE.

AGENTS:
New York—American News Co., 30 and 41 Chambers St.
Germany—B. Westermann & Co., of New York.

MONDAY, APRIL 22, 1895.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Supt. Enright's Views on How to Push the Placing of Gas Stoves.

OFFICE OF THE MERIDIAN GAS LIGHT CO.,
MERIDIAN, MISS., April 10, 1895.

To the Editor AMERICAN GAS LIGHT JOURNAL:

The practical working, sale and introduction of gas stoves to our consumers and the public have long since become matters of vital importance to us all, and it is certainly very difficult to suggest a plan of action to follow differing from the many forms already tested in this direction. The time has gone by for any of us to repeat the old saying of years ago, that the gas stove had not reached that state of perfection desired for all practical purposes. I think it only reasonable and fair to say that the manufacturers of gas cooking stoves (at least several of them) have very successfully met all of our demands in this direction, for the progress they have made in the last few years, in simplicity of design, size, durability, convenience and readiness of operation, perfect combustion and cost, is truly remarkable. And the fact that they have transferred all of the blame on to the shoulders of the gas manager as to bringing them into more general use cannot be successfully disputed. The paramount question now is, Why do we not succeed more fully in causing the stoves to be used by all of our consumers? To my mind the causes are many. In many localities the price of gas is too high, as compared with the cost of other forms of fuel, and while it is true that gas as fuel is worth more to the consumer, owing to safety, saving of labor, convenience, cleanliness and many other advantages, yet we should not lose sight of the fact that, in this period of depression, people are compelled to practice a vigorous economy. We follow this course, and why not give to them the same privilege? It is tiresome to hear some of our gas people constantly exclaiming over what the people ought to be. Accept them as they are, and build from that point, if you wish to attain success. We must endeavor to meet competition on its own ground and, by a superior service at or near the same cost, drive it from the field. In several instances the introduction and sale of stoves are intrusted to men who have no knowledge of the business, and who seem to be imbued with the idea that all that it is necessary to accomplish is the mere sale; then when a sale is consummated, the stove may be turned over to some incompetent person who has about as much knowledge of its practical working and interest in its success as a man has who does not own one. I find it far more profitable to have every detail of this important branch of our business under our own personal management. Make a good, practical display of your stoves in the office or some other convenient public place, having them all connected up and ready for exhibition at a moment's notice. Then advertise them properly and have their sale (if not done by yourselves) in the hands of a practical gas man, who not only possesses the ability to exhibit and explain the workings and many advantages over other systems of cooking now in use, but who is salesman enough to consummate a sale.

In each and every case where a purchaser is secured, your salesman should accompany the stove to its destination and see to it that the range is never connected up with less than an inch supply, always being careful to use not less than a 5-light meter. Then, when the stove is ready for use, let him call the lady of the house to inspect the stove, and while she is thus engaged he should explain its workings to her in the simplest manner possible, winding up his instructions by remarking that should she have any trouble with same to call you up and that you will be pleased to give it your prompt attention. This course will not only make her your agent, but will stand as a reference that you are at liberty to use at any and all times. As a rule it is an advantage to sell the stove at a lump price, including cost of erection, and the cost should not exceed the net cost of stove, pipe and labor. Many sales of stoves are lost through fear of cost of erection. Many companies erect them free of charge, and I believe that such enterprise is always well rewarded. Do not fear that a free and ample supply of gas to a stove will cause extravagant bills. Teach your consumers how to operate their stoves economically, and in such manner as to merit their ability to pay and arouse their interest to retain it. The canvassing plan is a good one, if in the hands of a competent person; and if your outlook will not justify you in employing a practical man in this line, it should be done by the superintendent himself. The renting of stoves and having the rental apply to purchase is a failure from the fact that in every community many people reside who will take advantage of your generosity. I find it better to sell at a given price, the charge to include delivery and connection, to be paid in two or three payments, if the purchaser so desires, they retaining the privilege of returning the stove within 30 days if it fails to give satisfaction. Always keep the latest and best designs on exhibition and for sale that can be purchased for the least money. I am well aware that the stove path is not abundantly strewn with flowers, but I also remember that success in any of our undertakings is accomplished only through hard work and close attention to same. Yours truly,

J. H. ENRIGHT, Supt.

The Market for Gas Securities.

Strength was the predominant feature of the city market for gas shares last week, Consolidated showing prominently in the transactions. Several sales were made at 136, and at noon today (Friday) the bid price was 136¼, holders demanding 136½. As we have been saying for the past six weeks, Consolidated looks to be a purchase, and there is every indication that our prediction of three weeks ago, to the effect that in the near future it would sell at a price higher than any heretofore made in it, will be realized.

New York and East River common scored an advance of 2¾ points in the bid price since time of last writing, and we look for it to go higher, in fact considerably higher. Perhaps it would serve no good purpose to repeat the rumors going round just now about certain dickerings under way respecting the future of the East River Company, but the general burden of rumor is all keyed to the tune of a substantial advance in the shares. Standard preferred is bid for at 99 ex div., and the common is pretty well along to the half par mark. Equitable is in good demand at 185 bid, ex and Mutual is steady at 156 bid.

Brooklyn shares are dull and strong. The time for making publicly known the merger terms is near at hand. Baltimore Consolidated climbed up to 63½ bid, and Bay State is a bit better than for some time. Chicago gas is steady, at 71½ ex div. Consumers, of Jersey City, is 74 bid, and the bonds are bid for at 95. The proprietors of the various ordinances for new gas companies in Chicago do not seem to be on a bed of roses, for the reform Mayor is evidently disposed to give to capital already invested in gas enterprises that measure of protection which their grants from the authorities were supposed to assure.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

APRIL 22.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	136¼	136½
Central	500,000	50	140	..
" Scrip	220,000	..	100	102
Equitable	4,000,000	100	184	187x
Bonds, 6's	1,000,000	1,000	105	107½
" 1st Con. 5's	2,300,000	1,000	112¾	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	156	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50		..
" Bonds	150,000	..	93	98
New York and East River	5,000,000	100	25	28
Preferred	2,000,000	100	45	47
Bonds	3,500,000	1,000	83¾	84½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	..	..	..
Standard	5,000,000	100	45	48
Preferred	5,000,000	100	99	100x
Bonds, 1st Mortgage, 5's	1,500,000	..	103¾	105
Yonkers	.....	50	112	..

Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	330,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	103	..
Peoples	1,000,000	10	90	.
" Bonds, 7's	308,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	200	..
" Ctf's	700,000	1,000	99	100
Williamsburgh	1,000,000	50	200	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	15	15¼	16
" Income Bonds	2,000,000	1,000	19½	20
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	73	75
2d " " "	3,000,000	1,000	48	50
Buffalo Mutual	750,000	100	120	..
" Bonds	200,000	1,000	95	100
Chicago Gas Co.	25,000,000	100	71⅛	71¼
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	93	93⅛
Columbus	1,000,000	..	..	..
1st Mortgage	1,085,000	..	..	..
Consumers. Jersey City	2,000,000	100	74	78
" Bonds	600,000	1,000	95	100
Cincinnati G. & C. Co.	7,000,000	100	..	208¾
Consumers, Toronto	1,600,000	50	184½	187
Central, San Francisco	.....	..	90	100
Capital, Sacramento	.....	..	..	50
Consolidated, Baltimore	11,000,000	100	63½	64
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400,000	..	..	..
Detroit	4,000,000	..	18	..
" Con. Bonds	4,312,000	..	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	76	78
" Bonds	2,000,000	..	84½	85½
Hartford	750,000	25	120	128
Indianapolis	2,000,000	..	144	148
" Bonds, 6's	2,650,000	..	103	..
Jersey City	750,000	20	105	..
Lafayette Gas Co., Ind	1,000,000	100	86	88½
Bonds	1,000,000	1,000	90	91½
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	25¾	26½
Preferred	2,500,000	100	82	84
Bonds	9,034,400	1,000	93	..
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	208
New Haven	.....	25	200	..
Oakland, Cal.	.....	..	42½	43
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	165	175
Paterson, N. J.	.....	25	90	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	81	..
Bonds, 6's	.....	..	..	..
Consolidated 5's	2,000,000	..	..	..
Syracuse, N. Y.	500,000	25	..	..
San Francisco, Cal.	10,000,000	100	73⅝	73¾
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	46½	47½
Bonds, 5's	3,556,000	..	83½	—
Wilmington, Del.	500,000	50	188	190

Advertisers' Index.

GAS ENGINEERS.

Page

Jos. R. Thomas, New York City ... 506
Wm. Henry White, New York City ... 595
Fred. Bredel, Milwaukee, Wis. ... 591
H. C. Slaney, Brooklyn, N. Y. ... 595
Geo. R. Rowland, New York City ... 595
The Western Gas Construction Co., Fort Wayne, Ind. ... 586
Humphreys & Glasgow, New York City ... 582
T. G. Lansden, St. Louis, Mo. ... 595
David Leavitt Hough, New York City ... 576

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. ... 593
United Gas Improvement Co., Phila., Pa. ... 585
Burdett Loomis, Hartford, Conn. ... 594
National Gas and Water Co., Chicago, Ills. ... 587
Economical Gas Apparatus Construct'n Co., Toronto, Ont 599
The Western Gas Construction Co., Fort Wayne, Ind. ... 586
A. M. Sutherland, New York City ... 579

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 596
Continental Iron Works, Brooklyn, N. Y. ... 594
Deily & Fowler, Phila., Pa. ... 596
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 592
Stacey Mfg. Co., Cincinnati, Ohio ... 595
Bartlett, Hayward & Co., Baltimore, Md. ... 593
Davis and Farnum Mfg. Co., Waltham, Mass. ... 592
R. D. Wood & Co., Phila., Pa. ... 594
Isbell-Porter Company, New York City ... 594
Fred. Bredel, Milwaukee, Wis. ... 591
United Gas Improvement Co., Phila., Pa. ... 585
Berlin Iron Bridge Co., East Berlin, Conn. ... 588
National Gas and Water Co., Chicago, Ills. ... 587
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 599
The Western Gas Construction Co., Fort Wayne, Ind. ... 586
Humphreys & Glasgow, New York City ... 582
Gas Engineering Co., Pittsburgh, Pa. ... 579

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City ... 595
R. D. Wood & Co., Phila., Pa. ... 594
James R. Floyd & Sons, New York City ... 596
Continental Iron Works, Brooklyn, N. Y. ... 594
Gas Engineering Co., Pittsburgh, Pa. ... 579

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. ... 593
Fred. Bredel, Milwaukee, Wis. ... 591
J. H. Gautier & Co., Jersey City, N. J. ... 591
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 590
Adam Weber, New York City ... 590

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City ... 595

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. ... 576
G. Shepard Page's Sons, New York City ... 595
Gas Engineering Co., Pittsburgh, Pa. ... 579

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 600
American Meter Co., New York and Philadelphia ... 589
The Goodwin Meter Co., Phila., Pa. ... 598
Helme & McIlhenny, Phila., Pa. ... 599
D. McDonald & Co., Albany, N.Y. ... 599
Nathaniel Tufts, Boston, Mass. ... 598
Maryland Meter and Mfg. Co., Baltimore, Md. ... 598
Harris Bros. & Co., Phila., Pa. ... 598
Metric Metal Co., Erie, Pa. ... 597

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio ... 597
M. J. Drummond, New York City ... 597
R. D. Wood & Co., Phila., Pa. ... 594
Warren Foundry and Machine Co., New York City ... 597
Donaldson Iron Co., Emaus, Pa. ... 597
Addyston Pipe and Steel Co., Cincinnati, O. ... 596
John Fox, New York City ... 597

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City ... 591

GAS COALS.

Penn Gas Coal Co., Phila., Pa. ... 580
Perkins & Co., New York City ... 588
Despard Gas Coal Co., Baltimore, Md. ... 580
Westmoreland Coal Co., Phila., Pa. ... 580
Shaner Coal Co., Philadelphia, Pa. ... 588
Berwind-White Coal Mining Co., New York and Phila. ... 588

CANNEL COALS.

Perkins & Co., New York City ... 588
Log Mountain Coal, Coke and Timber Co., Pineville, Ky. 589

GAS ENRICHERS.

Standard Oil Co., New York City ... 589
The Sun Oil Co., Pittsburgh, Pa. ... 589
W. H. Townsend, New York City ... 589

COKE CRUSHER.

C. M. Keller, Columbus, Ind. ... 580

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City ... 576

GAS GAUGES.

The Bristol Co., Waterbury, Conn. ... 591

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City. 587
Wilbraham Baker Blower Co., Phila., Pa. ... 587
Isbell-Porter Co., New York City ... 594

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City ... 594
Continental Iron Works, Brooklyn, N. Y. ... 594
G. Shepard Page's Sons, New York City ... 595

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J. ... 590
B. Kreischer & Sons, New York City ... 590
Adam Weber, New York City ... 590
Laclede Firebrick Mfg. Co., St. Louis, Mo. ... 590
Cyrus Borgner, Phila., Pa ... 590
James Gardner, Jr., Pittsburgh, Pa. ... 590
Henry Maurer & Son, New York City ... 590
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 590
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 590
Brooklyn Firebrick Works, Brooklyn, N. Y. ... 590
F. Behrend, New York City ... 580

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N. Y. ... 590
F. Behrend, New York City ... 580

INCANDESCENT GAS LAMPS.

Welsbach Light Co., Gloucester, N. J. ... 579

MICA GOODS.

The Mica Mfg. Co., New York City ... 576

BURNERS.

C. A. Gefrorer, Phila., Pa. ... 594
Moses G. Wilder, Phila., Pa. ... 576

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 576

GAS TUBING.

New York Gas Tubing Co., New York City ... 576

STREET LAMPS.

J. G. Miner, Morrisania, New York City ... 591
Bartlett Lamp Mfg. Co., New York City ... 591

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 587
Greenpoint Chemical Works, Brooklyn, N. Y. ... 587
Henry W. Douglas, Ann Arbor, Mich. ... 587
Read, Holliday & Sons, Ltd., New York City ... 580

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind. ... 584
Isbell-Porter Company, New York City ... 594
Wilbraham Baker Blower Co., Philadelphia, Pa. ... 587
Connelly Iron Sponge and Governor Co., New York City 587

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y. ... 588
Chapman Valve Manufacturing Co., Boston, Mass. ... 586
R. D. Wood & Co., Phila., Pa. ... 594
Continental Iron Works, Brooklyn, N. Y. ... 594
John Fox, New York City ... 597
The P. H. & F. M. Roots Co., Connersville, Ind. ... 584
Isbell-Porter Co., New York City ... 594
The Western Gas Construction Co., Fort Wayne, Ind. ... 586

ELECTRICAL APPARATUS.

Wm. Henry White, New York City ... 595

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa. ... 580
The American Gas Engine Co., Phila., Pa. ... 577

ENGINES AND BOILERS.

The Hazelton Boiler Co., New York City ... 580

PURIFIER SCREENS.

John Cabot, New York City ... 591

GAS STOVES.

American Meter Co., New York and Philadelphia. ... 583
The Goodwin Meter Co., Phila., Pa. ... 598
George M. Clark & Co., Chicago, Ills. ... 581
Maryland Meter and Manufacturing Co., Baltimore, Md. 598
The Schneider & Trenkamp Co., Cleveland, O. ... 580
William M. Crane & Co., New York City ... 581

CHINA GAS KILNS.

F. A. Wilke, Richmond, Ind. ... 596
William M. Crane & Co., New York City ... 581

GAS FLOW COMPUTERS.

Wm. Cox, Stapleton, N. Y. ... 593

COIN WRAPPERS.

Alvord & Co., Detroit, Mich. ... 456

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass. ... 586
New York Marine Paint Co., Poughkeepsie, N.Y. ... 586

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y. ... 591

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. ... 593
Continental Iron Works, Brooklyn, N. Y. ... 594
Deily & Fowler, Philadelphia, Pa. ... 596
Davis & Farnum Mfg. Co., Waltham, Mass. ... 592
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 592
Stacey Mfg. Co., Cincinnati, Ohio. ... 595
R. D. Wood & Co., Philadelphia, Pa. ... 594

A CARD.

CHICAGO, April 15, 1895.

My connection with the American Meter Company will terminate May 1st. Am open for an engagement with some firm or Gas Company. Would be willing to lease a small gas plant.

I take this opportunity of thanking my friends for the many favors extended to me in the past, and hope to keep in touch with them. JOHN STOUT,

125 S. Clinton Street, Chicago, Ills.

Situation Desired

As Superintendent of Either Coal or Water Gas Works,

By a man of vast experience, who is at present Superintendent of a Gas, Electric Light and Water Works, but desires a change in locality. Can give first-class references.

1037-3 Address "W. 217," care this Journal.

WANTED,

By a man who has had a round experience in the manufacture and sale of gas,

A Position as Supt. of a Large or Smal' Gas Works.

Is capable and energetic, and is willing to begin at a moderate salary. Address

1032-tf "B.," care this Journal.

FOR SALE,

Two Second-Hand Purifiers,

10 ft. by 15 ft. by 3 ft., 24-inch Cups, with Center Seal and Connections, all in good condition. Address

1036-tf "PURIFIER," care this Journal.

JUST WHAT YOU WANT!

A CATALOUGE OF

MICA CANOPIES

AND

MICA CHIMNEYS.

THE MICA MFG. CO.,

88 Fulton St., N.Y. City.

MOSES G. WILDER,

Mechanical Engineer,

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors,

Governor Gas Burners,

Gas Cocks and Fittings,

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters.* The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

Electrolysis Prevented

Gas Pipes and Water Pipes Protected from Corrosion of Electric Railway Currents by Patented Process.

IN USE AT NEWARK, N. J.

HAROLD P. BROWN, Electrical Expert,

Edison Building, New York.

Correspondence solicited from City Officials and Managers of Gas Works, Water Works, and Electric Railways. Refers to Thomas A. Edison, Orange, N. J.; F. S. Pearson, Chief Engr. Metropolitan Traction Co., N. Y.; David Young, Gen'l Mangr. Consolidated Traction Co., Jersey City; Harrison Van Duyne, Prest. Board of Works, Newark, N. J.; Newark City Gas Co., Newark, N. J. 1023-13

Patent Lava Gas Tips.

UNIFORMITY GUARANTEED.

ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,

CHATTANOOGA, TENN.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to

STROH & OBIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich

DAVID LEAVITT HOUGH,

19 W. 31st St., N. Y. City.

Investment Property Appraiser, Consulting and Contracting Engineer.

GAS, WATER, STREET RAILWAY AND FIREPROOF STRUCTURAL WORK.

Extensions to Existing Gas Plants and Initial Plants Designed. Bids obtained, checked and tabulated, ready for Board or Committee meetings. *Work followed at the Shops to secure Proper Attention and Speed, and Inspected during Erection.*

BINDER for the JOURNAL.

STRONG.

DURABLE.

LIGHT.

SIMPLE

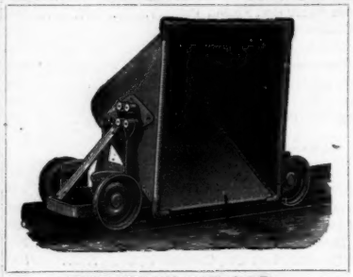
CHEAP.

HANDSOME.

Price, $1.

A.M. Callender & Co., 32 Pine st., N.Y. City.

G. W. HUNT COMPANY.



THE HUNT TIP CAR.

45 BROADWAY, - - NEW YORK.

COKE CARS for Gas Works,

TIP CARS for Carrying Ashes,

CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.

INDUSTRIAL RAILWAYS

Specially designed for handling material in and around

Gas Works, Coal Yards, Factories, Etc, Etc.

If You Want the Best GAS-TIGHT Tubing,

BUY OF THE

NEW YORK GAS TUBING CO.

334 & 336 East 23d St., N. Y.

GUARANTEED NOT TO STIFFEN. **Makers of All Kinds of Flexible Tubing.**

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved.

Price, Cloth, $6.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

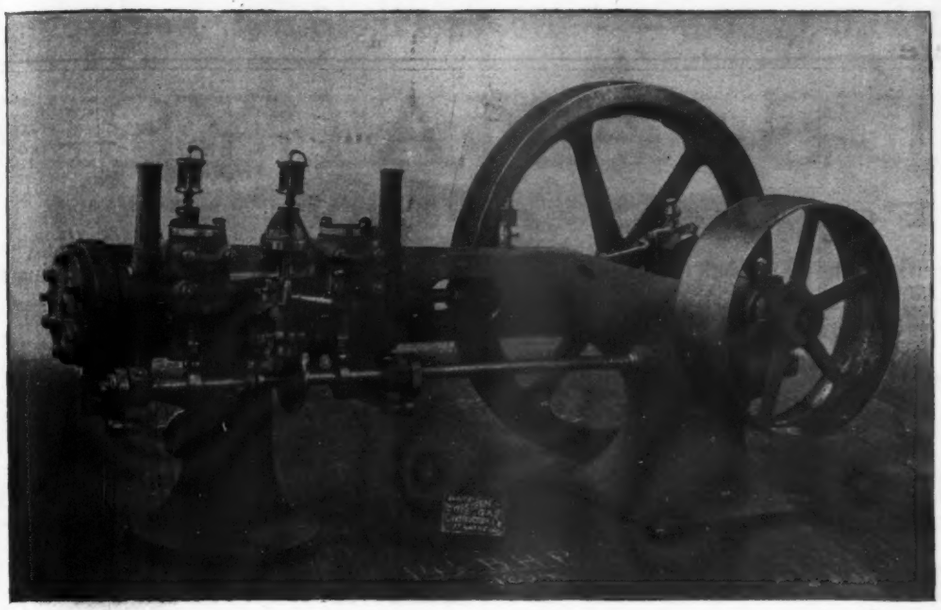
WM. W. GOODWIN, Prest. O. N. GULDLIN, V.-Prest. & Treas. H. B. GOODWIN, Sec. EARNEST F. LLOYD, Asst. Sec

THE AMERICAN GAS ENGINE CO.,

MANUFACTURERS OF

The Double-Acting Gas Engine,

Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.



***

Single Cylinder.

Impulse Every Revolution.

(Two Strokes.)

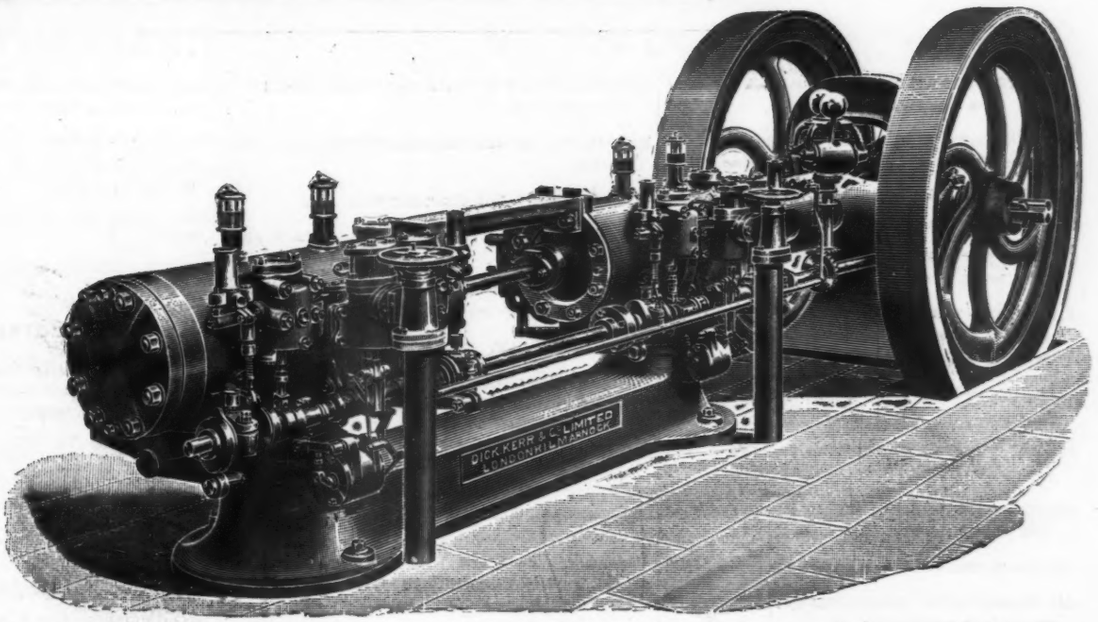
15 to 500 Horse Power.

For General Work and Isolated Electric Plants.

***

Tandem Cylinder. Impulse Every Stroke. 100 to 1,000 Horse Power.

For Central Stations and all work requiring extreme steadiness.



ESSENTIAL PRINCIPLE.—An impulse at each end of piston; using half force to each impulse; doubling the steadiness; reducing the wear on moving parts, and weight for given power. **CONSTRUCTION.**—The piston rod works through stuffing box in front end of cylinder, and connecting rod is carried in a cross-head working in a slide in frame, as in ordinary steam engine practice. All valves are of the poppet type, operated by cams on a single cam-shaft, giving positive movement to every working part. Tube or electric ignition. **RESULT.**—An engine of extreme simplicity and steadiness of action, the even wear on the cylinder and all working parts assuring increased economy, long life, and minimum cost in repairs. **RECORD.**—Successful and constant use in Great Britain for the past eight years. Address

W. W. GOODWIN, President, Lock Box 718, Philadelphia, Pa.., or
THE WESTERN GAS CONSTRUCTION CO., Bldrs. & Gen. Agts., Fort Wayne, Ind.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng., having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

FIELD'S ANALYSIS

For the Year 1893.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-third Year of Publication. Compiled and Arranged by

JOHN W. FIELD Accountant to the Gas Lt. and Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

SCIENTIFIC BOOKS.

ING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S GUIDE. $1.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

PRACTICAL PHOTOMETRY; A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT. By W. J. DIBDIN. $3.

TRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $5.

COAL; ITS HISTORY AND USE. by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHRYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.10.

AMMONIA AND AMMONIUM COMPOUNDS, by DR. R. ARNOLD. $2.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY, by Professor VICTOR VON RICHTER. $2.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

HANDBOOK FOR MECHANICAL ENGINEERS, by HENRY ADAMS. $2.50.

FUEL AND ITS APPLICATIONS. $7.50.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS, by THOS NEWBIGGING. Fifth edition. $6

A TREATISE ON MASONRY CONSTRUCTION. BARKER. $5

GAS ENGINEER'S LABORATORY HANDBOOK, by JOHN HORNBY, F I C., $2 50.

GAS LIGHTING AND GAS FITTING, by W. P. GERHARD. 50 cents.

AMERICAN PLUMBING, by ALFRED REVILL. $2.00.

ELECTRICITY.

THE ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage, and Distribution, by PHILIP ATKINSON. $1.50.

ELEMENTARY ELECTRICITY, by PROF. F. JENKIN. 40 cts

ELECTRIC TRANSMISSION OF ENERGY, by G. KNAPP. $3

ELECTRICIAN'S POCKET-BOOK, by MONROE and JAMIESON. $2.50.

MAGNETISM AND ELECTRICITY, by J. OVEREND. 40 cents.

ACCUMULATORS, by SIR D. SALOMONS. $1.50.

DYN. MO BUILDING, by F. W. WALKER. 80 cents.

ELECTRIC LIGHTING FROM CENTRAL STATIONS, by G FORBES. Paper. 40 cents.

DOMESTIC ELECTRICITY FOR AMATEURS, by E. HOSPITALIER. $3.

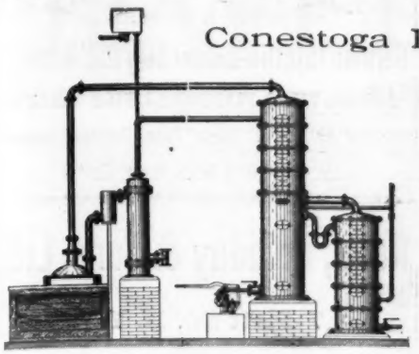
The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 32 Pine Street, New York.

GAS ENGINEERING COMPANY,

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEE AND OWNER OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENT FOR

FELDMANN AMMONIA MACHINE,

For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

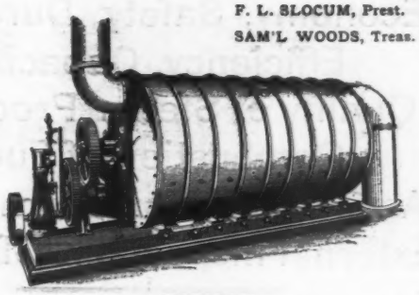
The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches,

JAS. GARDNER, JR.
SOLE CONSTRUCTOR AND BUILDER.

NEW SYSTEM HYDRAULIC MAIN.

F. L. SLOCUM, Prest.
SAM'L WOODS, Treas.



SCRUBBER.

THE LITTLE GIANT (AN IMPROVEMENT ON THE LOWE) GENERATOR.

Can be put into Coal Gas Works at a price the interest on which will not be so much as their present repair account.

This Generator is now in use in nearly every State in the Union, and everyone using it will recommend it to you.

It makes a faultless gas from whatever gas-producing materials are cheapest in the locality where required, using hard coal or coke in connection with Lima crude or any other crude petroleum or its distillates, including *Naphtha of any specific gravity.*

I build these Generators with any required capacity, from 3,000 cubic feet per hour upward.

In more than one half the gas works in the country the "Little Giant" will enable *one man* to easily make, in *five hours*, all the gas needed for the *twenty-four hours.*

Why struggle day and night, year after year, with high priced, low candle Coal Gas; with choked standpipes, broken retorts, naphthaline, and interminable other troubles and delays, while it is so easy to make an entirely better gas for less money in a quarter of the time, and having none of these drawbacks?

If gas coal is very cheap and anthracite coal and hard coke very expensive with you, put in a Little Giant Generator, as many others have done, *to increase candle power, to use up your surplus coke, and to rush up your holder when hard pressed.*

All work and results guaranteed.

A. M. SUTHERLAND, - - - No. 136 Liberty Street, N. Y. City.

THE GAS APPLIANCE EXCHANGE,
20 S. Fifteenth Street,
Philadelphia, Dec. 28th, 1894.

To COL. W. E. BARROWS, G. M., Welsbach Light Co., Gloucester, N. J.:

Dear Sir—Owing to the severe storm of Wednesday night, which did so much damage to telegraph, telephone and electric light property in the City, I considered it would be well to examine the Welsbach lights in Rittenhouse Square. I therefore sent a man to make a critical examination of the lights, after they had been lighted the following night. It gives me great pleasure to state that of the 48 lights in the Square, not one was out of order or required repairing, all of them being in perfect condition, and showing no sign of being affected by the storm.

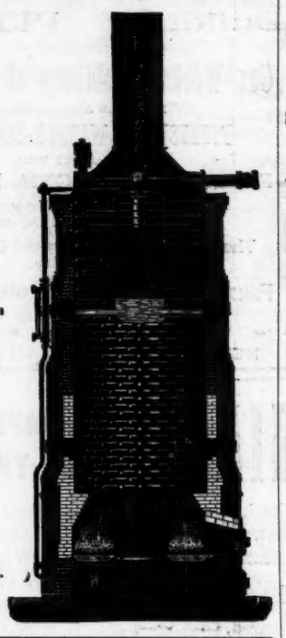
Very truly yours,

R. J. ROLSTON, Superintendent.

THE HAZELTON OR PORCUPINE BOILER.

Is Superior to All Others in

Economy, Safety, Durability,
Efficiency, Capacity,
Quality of Steam Produced,
Combustion of Fuel,
Accessibility for Internal and
External Inspection and Cleaning.



SEND FOR CATALOGUE AND REPORTS OF TESTS.

CORRESPONDENCE SOLICITED.

THE HAZELTON BOILER CO.,
Sole Proprietors and Manufacturers,
No. 716 East 13th Street, New York, U. S. A.

Cable Address, "PAILA," New York.
Long Distance Telephone, 1229--18th St., New York.

Not Connected with any other Concern in the U.S.

F. BEHREND,

SOLE IMPORTER OF THE CELEBRATED

German (Stettin-Didier) Clay Gas Retorts,

BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,

Stettin "Anchor" & "Eagle" Brand Portland Cement

10 & 12 Old Slip, New York.

Read, Holliday & Sons, Ltd.

No. 7 Platt St., N. Y. City.

HYDRATED OXIDE OF IRON

For Gas Purification.

Analysis, Samples and Particulars on Application.

THE CHEMISTRY OF ILLUMINATING GAS.

By NORTON H. HUMPHRYS. Price, $2.40.

Orders may be sent to

A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

PATENTS

Promptly secured. Trade-Marks, Copyrights and Labels registered. Twenty-five years experience. We report whether patent can be secured or not, free of charge. Our fee not due until patent is allowed. 32 page Book Free. H. B. WILLSON & CO., Attorneys at Law, Opp. U. S. Pat. Office. WASHINGTON, D. C.

RELIABLE GAS STOVES AND RANGES

By all odds the most Complete Line manufactured under one name, comprising all known Styles and Sizes.

More desirable improvements made in the **Reliable** line for 1895 than in all makes combined for the past ten years.

In addition to the many improvements, we have also added a complete new line of

High Grade Ranges,

swelling the **Reliable** line for 1895 to six distinct and separate lines of Ranges and three lines of Hot Plates, making in all

126 Sizes and 252 Styles, Ranging in Price form $2 to $84.

All the valuable improvements we have added for the coming season will give the **"Reliable"** a prestige as the leading line of Gas Ranges, and, being such a good thing, will undoubtedly be pushed along by others in 1896.

You will always find the **Reliable** line at least three years in advance of all competitors.

THE SCHNEIDER & TRENKAMP COMPANY, Sole Manufacturers,

Send for our 1895 Gas Catalogue. It cannot fail to Interest you.

Cleveland, O., and Chicago, Ill.

JEWEL GAS STOVES

This is One of Eight New Ranges.

For 1895

ARE MODERN

AND

UP TO DATE.

Two New Laundry Stoves.

Six New Square Junior Stoves.

WRITE FOR 1895 CATALOG.

56 Cooking Appliances.
Not a Padded Book.

GEORGE M. CLARK & COMPANY, Makers, CHICAGO.

Eastern Agency, 152 & 154 West 23d St., N. Y. City.

WILLIAM M. CRANE & CO.,

Office, 838 Broadway.
Factory, 428 & 430 W. 14th Street, New York City.

We carry the Most
Complete Line of
Gas Appliances in the
Country.
Gas Fires, Gas Logs,
Fire Place Heaters,
Ranges, Broilers,
Laundry Stoves,

WILLIAM M. CRANE AND CO. VULCAN NEW YORK. TRADE MARK.

Tailor Stoves,
Soldering Furnaces,
Griddles,
Waffle Stoves,
Hot Plates,
Gas Kilns, etc., etc.
A Complete New Line
of Ranges for 1895.

Send for Description of our NEW VULCAN Gas Furnace, for HOT AIR or HOT WATER.

Gas Controllers, Meter and Service Cocks, Independent and Hose Cocks, and Fittings of all kinds, with Extra Large Gas Way.

SEND FOR NEW CATALOGUE. WILL BE ISSUED ABOUT MARCH FIRST.

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Lynn Gas and Electric Company, at Lynn, Mass. The building is 37 feet in width by 64 feet in length, with brick side walls and an Iron Truss Roof covered with corrugated iron. A building of this kind cannot possibly take fire, as the interior appointments are such that there is little or no woodwork used about the construction of the plant, and no woodwork used about the side walls or roof.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

ALEX. C. HUMPHREYS, M.E., MANHATTAN LIFE BUILDING, (64 BROADWAY,) NEW YORK.

CABLE ADDRESS, LONDON & NEW YORK, "HUMGLAS."

ARTHUR G. GLASGOW, M.E., 9 VICTORIA ST., LONDON, S. W., ENGLAND.

HUMPHREYS & GLASGOW,

CONTRACTING AND CONSULTING

GAS ENGINEERS.

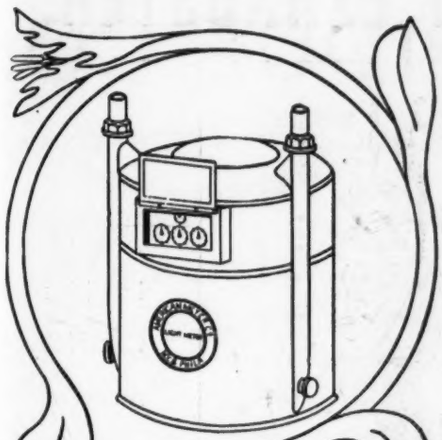
WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

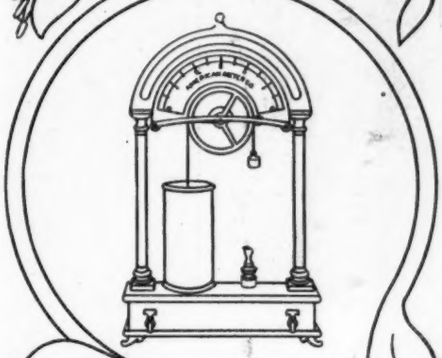
THE MANAGEMENT OF SMALL GAS WORKS.

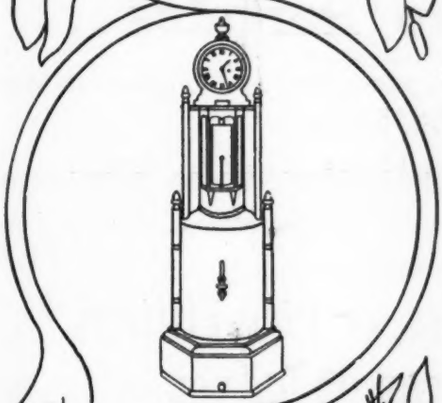
By C. J. R. HUMPHREYS.

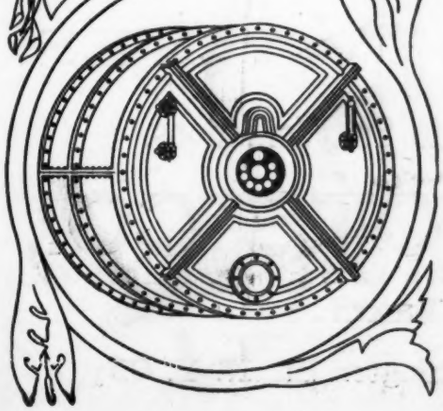
Price $1.

A. M. CALLENDER & CO., No. 32 Pine Street, New York.









(Copyrighted, 1894, by the AMERICAN METER CO.)

AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1868.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST LOUIS,

SAN FRANCISCO.

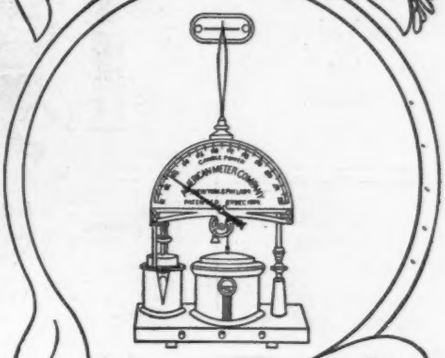
PUBLIC LIGHTING TABLE.

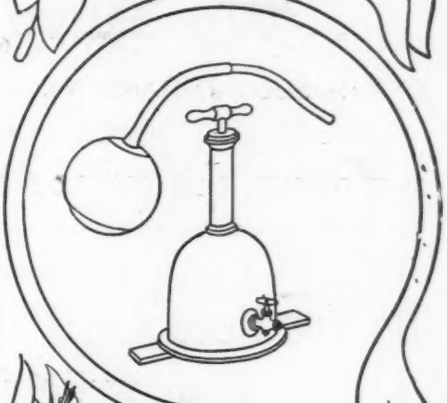
MAY, 1895.

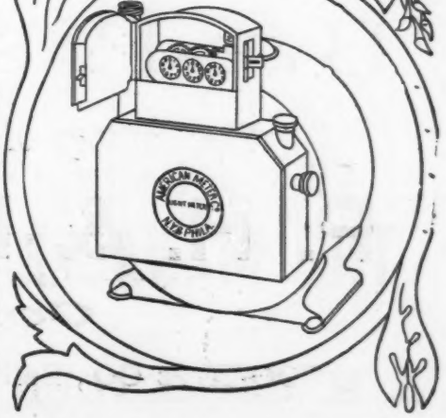
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Wed.	1	12.40 AM FQ	4.00 AM	6.45	4.00
Thu.	2	1.10	4.00	6.45	4.00
Fri.	3	1.30	4.00	6.45	4.00
Sat.	4	2.00	4.00	6.45	4.00
Sun.	5	2.20	3.50	6.45	4.00
Mon.	6	2.50	3.50	6.45	4.00
Tue.	7	No L.	No L.	6.55	3.40
Wed.	8	No L. FM	No L.	6.55	3.40
Thu.	9	No L.	No L.	6.55	3.40
Fri.	10	7.30 PM	10.30 PM	6.55	3.40
Sat.	11	7.30	11.30	6.55	3.40
Sun.	12	7.40	12.20 AM	6.55	3.40
Mon.	13	7.40	1.00	6.55	3.40
Tue.	14	7.40	1.30	7.00	3.30
Wed.	15	7.40	2.00	7.00	3.30
Thu.	16	7.40 LQ	2.20	7.00	3.30
Fri.	17	7.40	2.40	7.00	3.30
Sat.	18	7.40	3.00	7.00	3.30
Sun.	19	7.40	3.20	7.00	3.30
Mon.	20	7.40	3.40	7.00	3.30
Tue.	21	7.40	3.40	7.10	3.15
Wed	22	7.40	3.40	7.10	3.15
Thu.	23	7.40	3.40	7.10	3.15
Fri.	24	7.40 NM	3.40	7.10	3.15
Sat.	25	7.40	3.40	7.10	3.15
Sun.	26	7.50	3.30	7.10	3.15
Mon.	27	7.50	3.30	7.10	3.15
Tue.	28	7.50	3.30	7.15	3.15
Wed.	29	11.10	3.30	7.15	3.15
Thu.	30	11.40 FQ	3.30	7.15	3.15
Fri	31	12.00	3.30	7.15	3.15

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146 30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

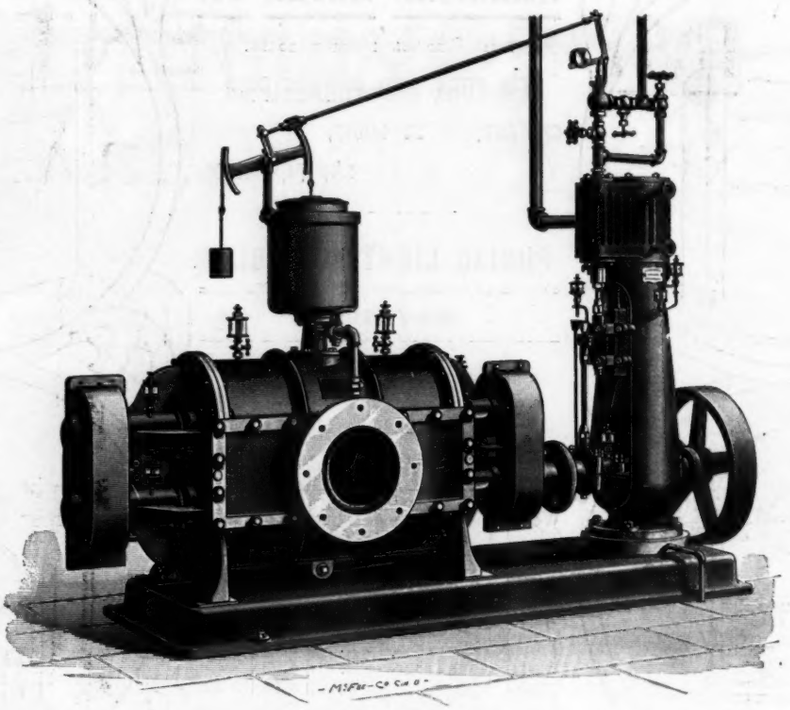






ROOTS' LATEST IMPROVED EXHAUSTER.

Our Latest Improved **Automatic Gas Governor** and **Steam Bye-Pass Valve** are the best in the market.



Inquiries Cheerfully Answered.

Send for Catalogue.

.. We Have For Sale Two Bargains ..

ONE, A SECOND-HAND No. 6 EXHAUSTER, with 12-inch Connections and Engine on same Bedplate, with Governor, etc., complete; run but a short time. Write for price.

THE OTHER, OUR WORLD'S FAIR EXHAUSTER AND ENGINE COMBINED ON SAME BED-PLATE. Run not to exceed one week; size, No. 6. Special prices that will be attractive on either of above.

Do You Need Any Valves, Bye-Pass Valves, or Pipe Fittings?
If so, write us, and see what we can do for you.

BYE-PASS AND GAS VALVES.

Pipe Fittings of all Kinds and Designs to Suit Conditions.

P. H. & F. M. ROOTS CO.,

Connersville, Ind.

COOKE & CO., Selling Agts.. 163-165 Washington St.. N. Y. City.

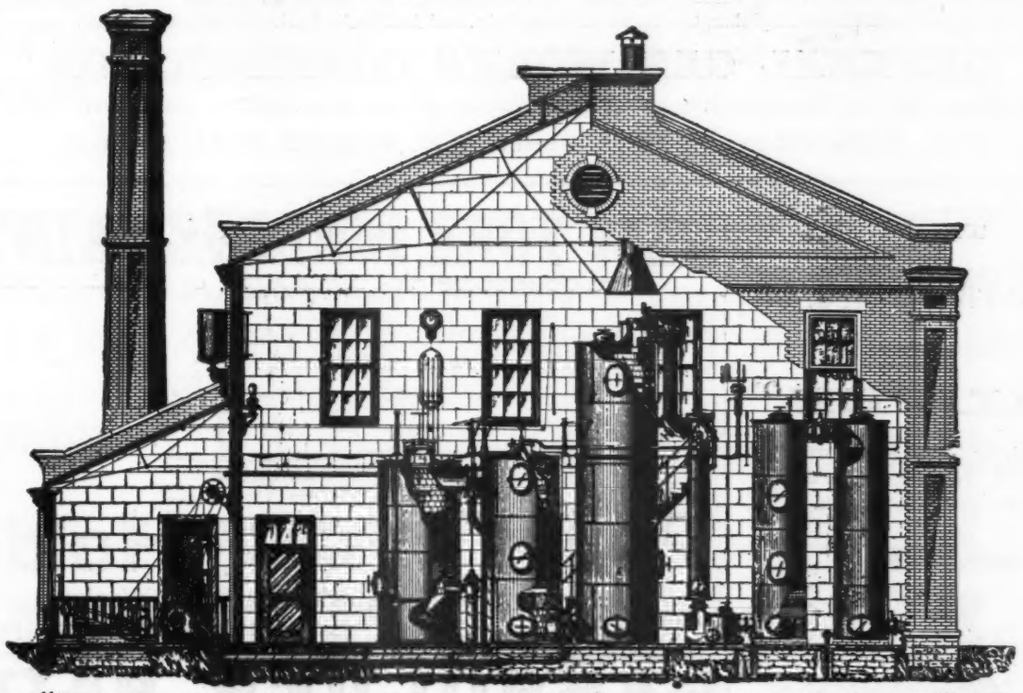
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

BUILDERS, LESSEES AND PURCHASERS OF GAS WORKS.

Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

THE WESTERN
GAS CONSTRUCTION CO.,

ENGINEERS and BUILDERS,

FORT WAYNE, INDIANA.

IMPROVED LOWE WATER GAS APPARATUS.

Special No. I Setting, for Small Works.

Standard Setting, Carbureter and Superheater combined in one shell, with independent blasts. All capacities.

Double Superheater Setting. Separate Carbureter and Superheater.

Improved Double Superheater Setting, having a Vaporizing Chamber in the Top of the Carbureter (Patented Nov. 13th, 1894). This IMPROVED SETTING can be applied to the ordinary Settings now in use.

All settings (except No. 1) are built with or without our Ball Valve Connection for "up and down runs." Our Apparatus will use any grades of Oils or Naphthas, Gas House or Oven Coke, and Anthracite Coal. Results guaranteed.

GENERAL GAS WORKS CONSTRUCTION.

Purifiers, Holders, Coal Gas Benches, Hub and Flange Valves, Street Main Specials, Condensers, Scrubbers, Etc.

New York Office, 32 Pine Street, WM. HENRY WHITE, Engr.

THE

LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ½ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:
938 to 954 River St., & 67 to 83 Vail Av.
TROY, N. Y.

NEW YORK MARINE PAINT CO.

Successors to TRACY & HADDEN.

TRADE MARK

MANUFACTURERS OF

PAINT PECULIARLY ADAPTED TO STAND ON Holders

And all Ironwork about Gas Works.

POUGHKEEPSIE, N. Y.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO. 104 High Street, Boston, Mass.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independen Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston Mass
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St

NATIONAL GAS AND WATER CO.,

218 La Salle St., Chicago, Ill.

IRWIN REW, President and Treasurer. E. E. MORRELL, Vice-President and Engineer. N. A. McCLARY, Secretary and General Manager.

Builder and Operator of Gas Works.

SOLE OWNER OF THE

REW APPARATUS,

FOR THE MANUFACTURE OF CARBURETED WATER GAS DIRECTLY FROM LOW GRADE SOFT COAL AND CRUDE OIL AND NAPHTHA.
A DEMONSTRATED SUCCESS.

SOLE OWNER OF THE

MORRELL APPARATUS,

FOR THE MANUFACTURE OF CARBURETED WATER GAS FROM HARD COAL OR COKE AND CRUDE OIL OR NAPHTHA. A WELL-KNOWN TYPE, SIMPLE, ECONOMICAL AND EFFICIENT.

PLANS AND GUARANTEED ESTIMATES FURNISHED UPON APPLICATION.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION; REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 365 Canal St., New York.

WILBRAHAM BAKER BLOWER COMPANY,

Successors to WILBRAHAM BROS.,

Philadelphia, Pa.,

SOLE MAKERS OF

THE HUNTOON GAS GOVERNOR,

The Best Governor in the Market for Rotary or Steam Jet Exhausters.

Wilbraham Gas Exhausters,

BAKER ROTARY PRESSURE BLOWERS,

And Rotary Piston Pumps.

Catalogues and Prices on Application.

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING

Standard Gas Coals and Cannel:

Ocean Mine Youghiogheny Gas Coal,

Clinch Valley Gas Coal, and the

Old Kentucky Shale, for Enriching Purposes.

Cargo Shipments from New York, Philadelphia, Baltimore and Norfolk.

Single carloads or more delivered at any required point in the United States or Canada.

The Celebrated **SHANER GAS COAL**

CORRESPONDENCE SOLICITED.

Is Mined and Shipped from the Best Gas Coal Basin in Pennsylvania.

SHANER COAL CO., - 1326 Chestnut Street, Philadelphia.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Gas Coal.

***

Offices:

55 Broadway, New York.

Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

850 Pages, Full Gilt Morocco. Price, $8.00.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

The Chemistry of Illuminating Gas.

By NORTON H. HUMPHRYS. Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

Management of Small Gas Works.

By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

GAS ENRICHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point, Baltimore, Md.
OFFICE, - - - 44 South Street, Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

ENRICH YOUR GAS

WITH OUR

"BEAR CREEK" CANNEL

Containing

14,630 Cu. Ft. of 41-Candle Gas and 995 lbs. of good Coke per ton of 2,240 lbs.

Log Mountain Coal, Coke & Timber Co.,

PINEVILLE, KY.

MACFARLANE & CO., Louisville, Ky., Agts. for U.S. and Canada.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER, Sec. & Supt. Gas Lt. & Coke Co., **Columbus, Ind.**

Correspondence Solicited.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

A. M. CALLENDER & CO., 32 Pine Street, New York.

WILBUR H. TOWNSEND,

BROKER AND DEALER IN

Naphthas, Gas and Fuel Oils and Crude Petroleum for Gas Companies.

Room 115. 29 Broadway, N.Y. City.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. MCCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.,

OHIO CRUDE OIL,

38 to 41 Degrees Gravity.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited

26 Broadway, New York City.

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels.
H. GAUTIER, Prest. CHAS. E. GREGORY, Vice-Prest.
DAVID R. DALY, Sec. & Treas., Gen'l Mangr.

Brooklyn Fire Brick Works,
MANUFACTURERS OF
CLAY RETORTS, FIRE BRICK.
Gas House and other Tile.
Office, 88 Van Dyke St., Brooklyn, N. Y

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN FIRE BRICK AND ENAMELED CLAY RETORT WORKS.
ADAM WEBER, Proprietor.
Works, Weber, N. J.
Office, 633 East 15th St., New York.
Modern Recuperative Furnaces
AND
Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Conestoga Bldg., Wood & Water Sts.
PITTSBURGH, PA. P. O. Box 373.
Successor to WILLIAM GARDNER & SON.
Fire Clay Goods for Gas Works.
SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,
(ESTABLISHED 1856.)
EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y
Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.
A cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.
PRICE LIST.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "
C. L. GEROULD & CO.,
N. 3d & Prospect Avs., Mt. Vernon, N.Y.
Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,
CITY OFFICE,
Mermod-Jaccard Building, St. Louis, Mo.
PROPRIETORS OF THE
OAKHILL GAS RETORT & FIRE BRICK W'KS
Our immense establishment is now employed almost entirely in the manufacture of
Materials for Gas Companies
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct
Half and Full Depth Benches of Our Own Design,
Containing 6, 8 or 9 Retorts.
We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt
BALTIMORE RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT BALTIMORE MD.
Clay Retorts, Blocks & Tiles
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 19x19x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents for New England States.

King's Treatise on Coal Gas. In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.
Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances. A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

Recuperative Furnaces, Purifying Machines,

* Gas Apparatus. *

No. 118 Farwell Avenue, Milwaukee, Wis.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.

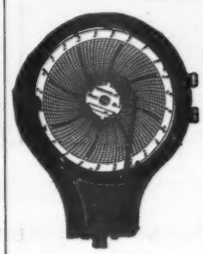
506-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET
Send for Circulars.

BRISTOL'S RECORDING **PRESSURE GAUGE**

For Continuous Records of

Street Gas Pressure.



Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

THE BRISTOL CO.
Waterbury, Conn.

Received Medal at World's Columbian Exposition.

GASHOLDER TANKS AND
GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
70 Rush St., Near Division Ave., Brooklyn, N.

The Gas Engineer's Laboratory Handbook.

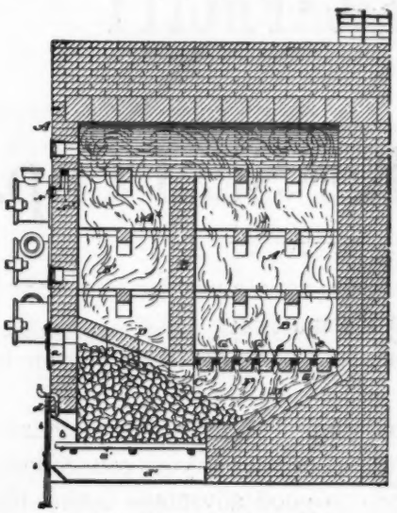
By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine Street N. Y. City

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL.

$3.00 per Annum.

A. M. CALLENDER & CO.
32 Pine Street, N. Y.

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Lamp Mfg. Company,

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

39 & 41 W. Broadway, New York City.

Gas Companies and others intending to erect Lamp and Posts will do well to communicate with us.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY

H. E. PARSON, Supt., 621 Broadway, N. Y.

DAVIS & FARNUM MFG. CO.

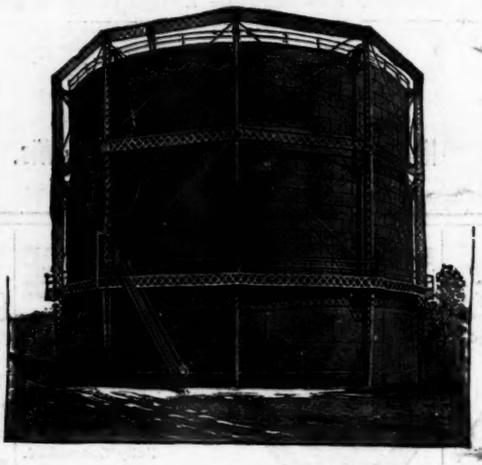
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, WALTHAM, MASS. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

Single, Double and Triple-Lift

Gasholders

of any Capacity.



Tubular, Pipe and Sinuous Friction

Condensers

of all Sizes.

Steel Tanks for Gasholders.

Iron Roof Frames and Floors.

PURIFYING BOXES, CENTER SEAL OR VALVE CONNECTIONS.

BENCH WORK, REVERSIBLE LIME TRAYS.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

GAS AND WATER PIPE, FLANGED PIPE,

Sugar House Work, and Special Castings of all Description.

INCREASE YOUR PURIFYING CAPACITY

BY THE USE OF THE

"Crighton" Four-Box Center Seal Cap.

Having recently perfected and patented a Five-way Center Seal Cap, we are now in position to offer and recommend it to Gas Companies for increasing their purifying capacity at a moderate cost.

With this Cap you can have **all your Purifying Boxes in constant use,** and where four boxes are in operation at one time, **the capacity is increased one-third.**

Your present Center Seal can be used, and will **only require a new Cap.** Under ordinary circumstances **the change can be made in one day,** and will not necessitate the disturbing of your connections.

Now is the time to make the change, as the work can be done to good advantage during the season of your lightest output.

For information and prices address

KERR MURRAY MFG. CO.,

Manufacturers of Gas Works Apparatus and Holders,

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double & Single-Lift

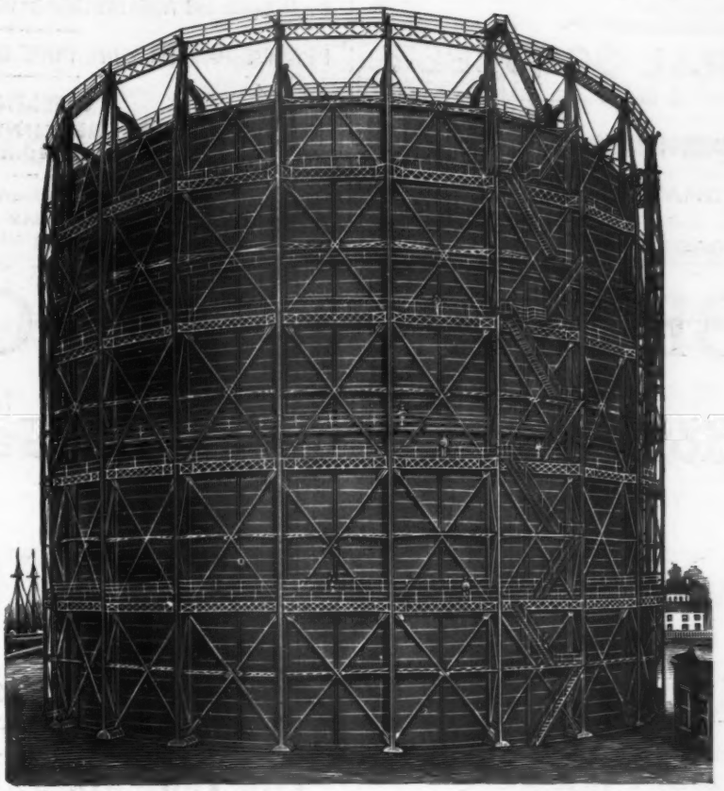
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS



PURIFIERS.

CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS.

Boilers.

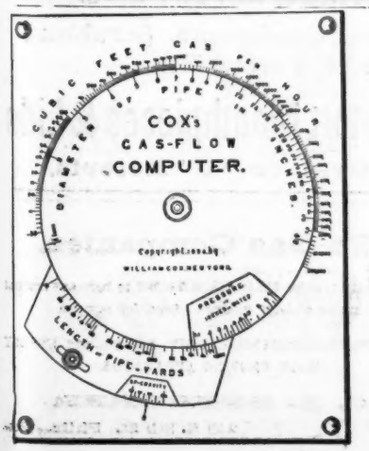
Three Four-Lift Gasholders, each of 4,289,500 Cubic Feet Capacity, Erected in Chicago.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.



Cox's Gas Flow Computer.

1. It gives at a glance the discharge of gas from pipes 1 to 48 inches in diameter and 10 to 10,000 yds. long, for any pressure from 0.1 to 4.0 inches of water, and any specific gravity from 0.40 to 1.00.

2. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is at once seen.

3. When the required discharge and the length of pipe are given, the pressure corresponding to any diameter is at once found.

4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.

Price, $10.00, per Registered Mail.

Where it can be seen and proved:

A. M. CALLENDER & CO., 32 Pine St., N.Y., or WM. COX, C.E., Stapleton, N. Y.

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED)

PURIFIERS, CONDENSERS, SCRUBBERS.

THE HOPPER AUTOMATIC GAS GOVERNOR.
BENCH WORK. PLATE GIRDERS.
IRON FLOORS AND ROOFS.

BUILDERS OF

GAS HOLDERS

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks

PEASE'S PATENT WIRE ROPE GUIDING FOR GAS HOLDERS

CUTLER'S
PATENT FREEZING PREVENTER
FOR GAS HOLDER CUPS.

THE TAYLOR REVOLVING BOTTOM GAS PRODUCER,
HEAVY LOAM CASTINGS, DUNHAM SPECIALS, HYDRAULIC WORK
LAMP POSTS, VALVES, ETC.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

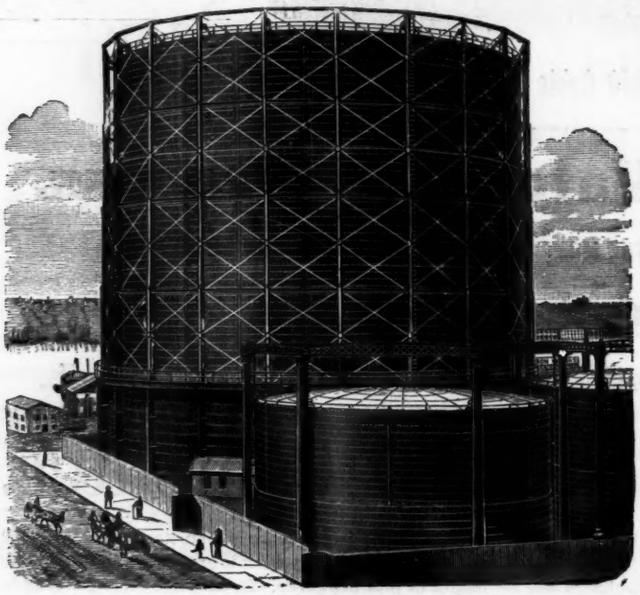
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— Bridge & Ogden Sts., Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM N. Y. TO GREENPOINT.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers
Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

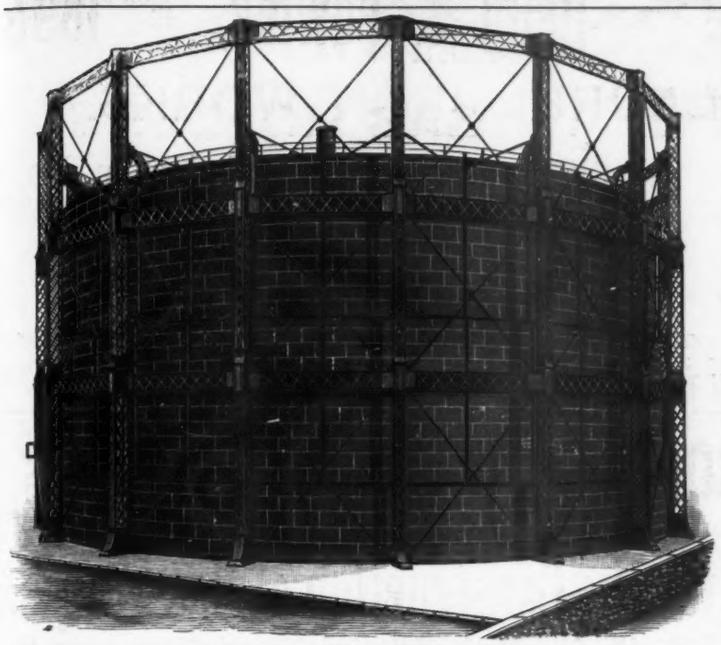
To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO.
Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

George Shepard Page's Sons,

Sole Agents for

The "Standard" Washer-Scrubber,

The Walker Tar and Carbonic Acid Extractor, The Walker Sulphate and Ammonia Still,
The Walker Self-Sealing Pressed Steel Mouthpiece Lids.

The Berlin Center Valve. And Contractors for Ammoniacal Liquor.

No. 69 Wall Street, New York City.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

H. C. SLANEY,
Gas Engineer
466 Sixth Street, Brooklyn, N. Y.
Plans, Specifications and Estimates furnished for New Works, Alteration or Extension of Old Plants.

T. G. LANSDEN,
Consulting and Contracting Gas Engineer.
Estimates, Plans and Specifications for New Works (Coa or Water Gas), and for Extensions or Alterations.
Security Bldg. (Room 206), St. Louis, Mo.

WM. HENRY WHITE,

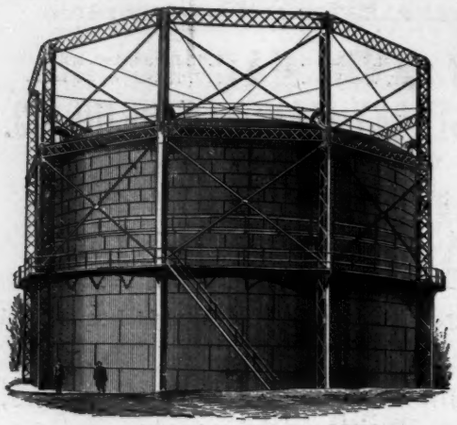
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1895

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD & SONS,

Successors to HERRING & FLOYD,

Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

Premium Awarded, World's Columbian Exposition.

SELLER'S CEMENT. Plans, Specifications and Estimates furnished for the Construction of New or the Alteration of Old Works.

INTERESTING TO GAS MANUFACTURERS!

The

Wilke China Kiln.

For Firing Decorated China with Illuminating Gas.

AWARDED THE HIGHEST HONORS, MEDALS AND DIPLOMAS AT THE WORLD'S COLUMBIAN EXPOSITION.

Many Valuable Improvements added to this Kiln in the Last Year.

Not a Toy, but a Practical Kiln.

Has Never Failed to Give Satisfaction.

Guaranteed to fire China successfully, and without any discoloration from fuel used.

Thousands in use, and not a single failure.

Full directions furnished with each Kiln sold by which any amateur can fire it without any previous knowledge of this branch of the work. Send for descriptive circular. Address

F. A. WILKE,
Richmond, Ind.

Cast Iron Pipe For Natural or Artificial Gas,

Also Specials or Branch Castings, Lamp Posts of many designs, Gas Street Lamps, etc. Please write for illustrated pamphlet and for prices.

The Addyston Pipe & Steel Co. Cincinnati, O.

The Gas Engineer's Laboratory Handbook.

BY JOHN HORNBY, F.I.C. Price, $2.50.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York City.

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

GAS AND WATER PIPES.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

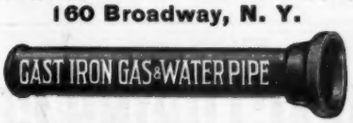
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

Columbus, Ohio.

JOHN FOX,

160 Broadway, N. Y.



SPECIAL CASTINGS, FLANGE PIPE, FIRE HYDRANTS, STOP VALVES, LAMP POSTS, Etc., Etc.

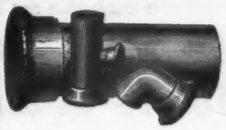
General Foundry and Machine Work.

GAS METERS.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

1894 DIRECTORY 1894

OF AMERICAN GAS COMPANIES

Price, - - - - - - - - - $5.00.

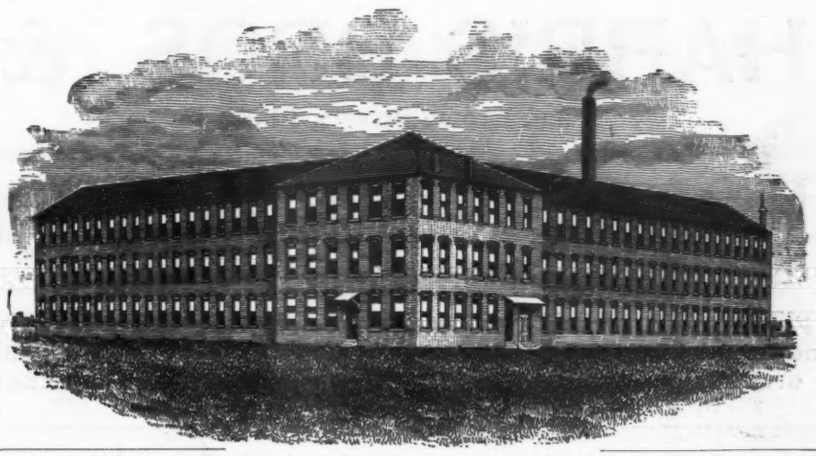
A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

N. Y. AGENCY,

Bartlett Lamp Mfg. Co.,

39 & 41 W. Broadway,
New York City.

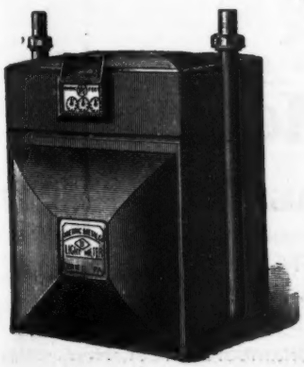
Telephone, 1125 Courtlandt.



Factory and Office

ERIE, PA.

ESTIMATES FURNISHED ON APPLICATION.



METRIC METAL CO.,

MANUFACTURERS OF

Dry Gas Meters

FOR ALL KINDS OF SERVICE.

Special Attention Paid to
REPAIRING METERS OF ALL MAKES.

Agts., McELWAINE-RICHARDS CO., 62 & 64 W. Maryland St., Indianapolis, Ind

Established 1849.

With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

153 Franklin St., Boston, Mass.

C. W. HINMAN, - - Manager.

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**

NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**

BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Phila., Pa.

Agency, 67 & 69 S. Canal Street, Chicago.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

THE GOODWIN METER COMPANY,

1012-1018 Filbert Street, Philadelphia, Pa.

MANUFACTURERS OF

Consumers' and Station Meters,

Standard Photometrical and Analytical Gas Apparatus

"SUN DIAL" GAS COOKING AND HEATING STOVES.

Particular attention given to Repairing Meters and Scientific Apparatus. . . .

GEORGE B. EDWARDS, Agent,

113 Chambers Street, N. Y. City.

GAS METERS. GAS METERS. GAS METERS.

WM. N. MILSTED, Prest. and Genl. Supt. WM. H. HOPPER, Vice-Prest. PAUL S. MERRIFIELD, Sec. and Treas.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories: 512 West 22d St., N. Y. Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies: 125 & 127 S. Clinton Street, Chicago. 810 North Second Street, St. Louis. 223 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

Gas Meter Manufacturers

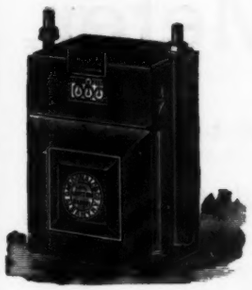
1339 to 1349 Cherry Street, Philadelphia, Pa.

Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Center Seals, Pressure Registers, Governors, Indicators, Photometers

AND ALL OTHER KINDS OF APPARATUS FOR USE IN GAS WORKS.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of ALL MAKERS.



D. McDONALD & CO.,

Established 1854.

154 West 27th Street, NEW YORK CITY. 51, 53 & 55 Lancaster St., ALBANY, N. Y. 34 & 36 W. Monroe St., CHICAGO, ILL.

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. L. L. MERRIFIELD, Chief Engineer.

The Economical Gas Apparatus Construction Co., Ld.

269 Front Street, East, - - Toronto, Canada.

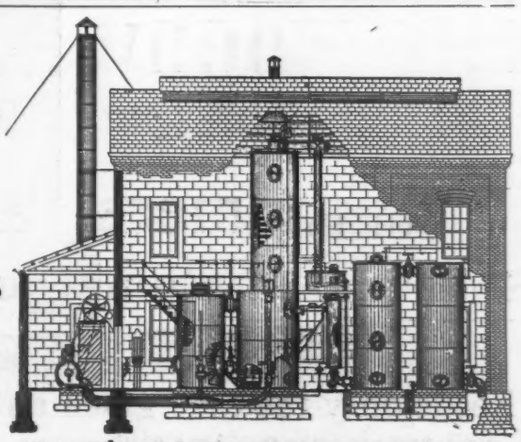
ENGINEERS AND BUILDERS OF THE

Improved Lowe Water Gas Apparatus

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.



LOWE WATER GAS APPARATUS, MERRIFIELD-WESTCOTT-PEARSON SETTING.

The Advertisement of the

OTTO GAS ENGINE WORKS,

33d and Walnut Streets, Philadelphia,

New York, 18 Vesey St. Boston, 19 Pearl St., Chicago, 245 Lake St.,

Occupies this space every alternate week.

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York. WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago. FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

We manufacture in the United States, under the **SAWER & PURVES PATENTS,** the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs only the care given an ordinary Meter. Saves MONEY, TIME and CONSUMERS, Dispenses with "DEPOSITS" and increases OUTPUT.